DOCUMENT RESUME

ED 377 024 SE 053 166

AUTHOR Bonhotal, Jean F.; Krasny, Marianne E.
TITLE Composting: Wastes to Resources. 4-H Leader's/Teacher's Guide.
INSTITUTION Cornell Univ., Ithaca, N.Y. Cooperative Extension Service.
PUB DATE Apr 90
NOTE 64p.; Oversize posters reproduced in sections.
AVAILABLE FROM Cornell Waste Management Institute, Center for the Environment, Cornell University, 468 Hollister Hall, Ithaca, NY 14853-3501.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Elementary Secondary Education; *Environmental Education; *Recycling; Solid Wastes; *Student Projects; *Waste Disposal; Worksheets
IDENTIFIERS *Composting

ABSTRACT

This guide is designed for adult volunteer leaders, camp counselors, and teachers who want to set up composting projects with youth. Five sections explore: (1) an introduction to composting with illustrated instructions for making compost; (2) different methods of composting and structures needed for various composting systems; (3) how to identify and fix problems in compost piles using a problem-solving exercise worksheet; (4) six ideas for what can be done with compost; and (5) a series of six compost investigations with student worksheets. Each teacher reproducible investigation covers one or more "compost concept." Concepts include the importance of air, microorganisms, soil animals and compost food chains, organisms that break down wastes, biodegradable and nonbiodegradable wastes, air and size of wastes, and wastes as resources. Investigations involve students in observing, collecting data, recording data, and analyzing results. Additional reproducible worksheets contain a compost project record sheet and designs for different composting systems. Two posters illustrate how composting works and composting instructions. Black-and-white illustrations make instructions easy to follow. Contains a 30-word glossary and a listing of 15 additional resources. (LZ)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 377 024

EXPERIENCE

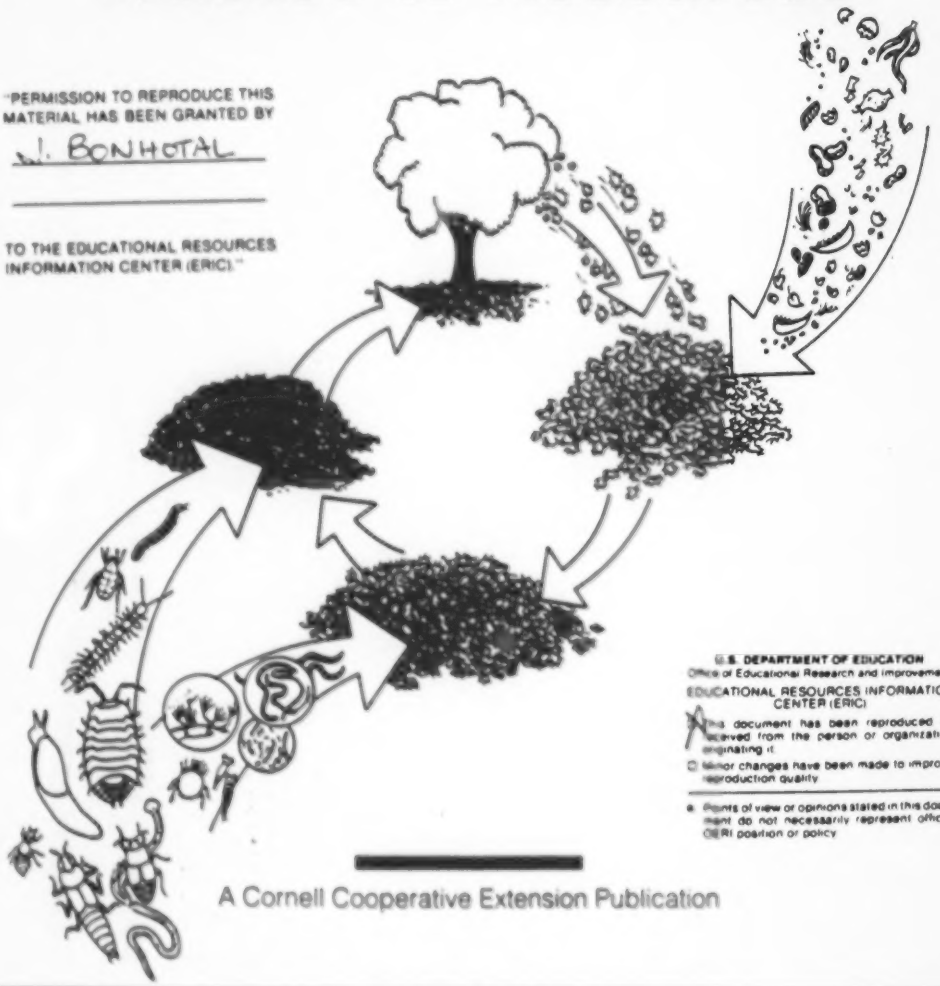
4-H NATURAL RESOURCES

Composting:
Wastes to Resources

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

J. BONHOTAL

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."



U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

A Cornell Cooperative Extension Publication

SE053814o

BEST COPY AVAILABLE

Contents

Leader's/Teacher's Guide

- Composting: Wastes to Resources

Compost Project Record

Posters

- Best Ever Compost
- How Does Composting Work?

Designs for Composting Systems

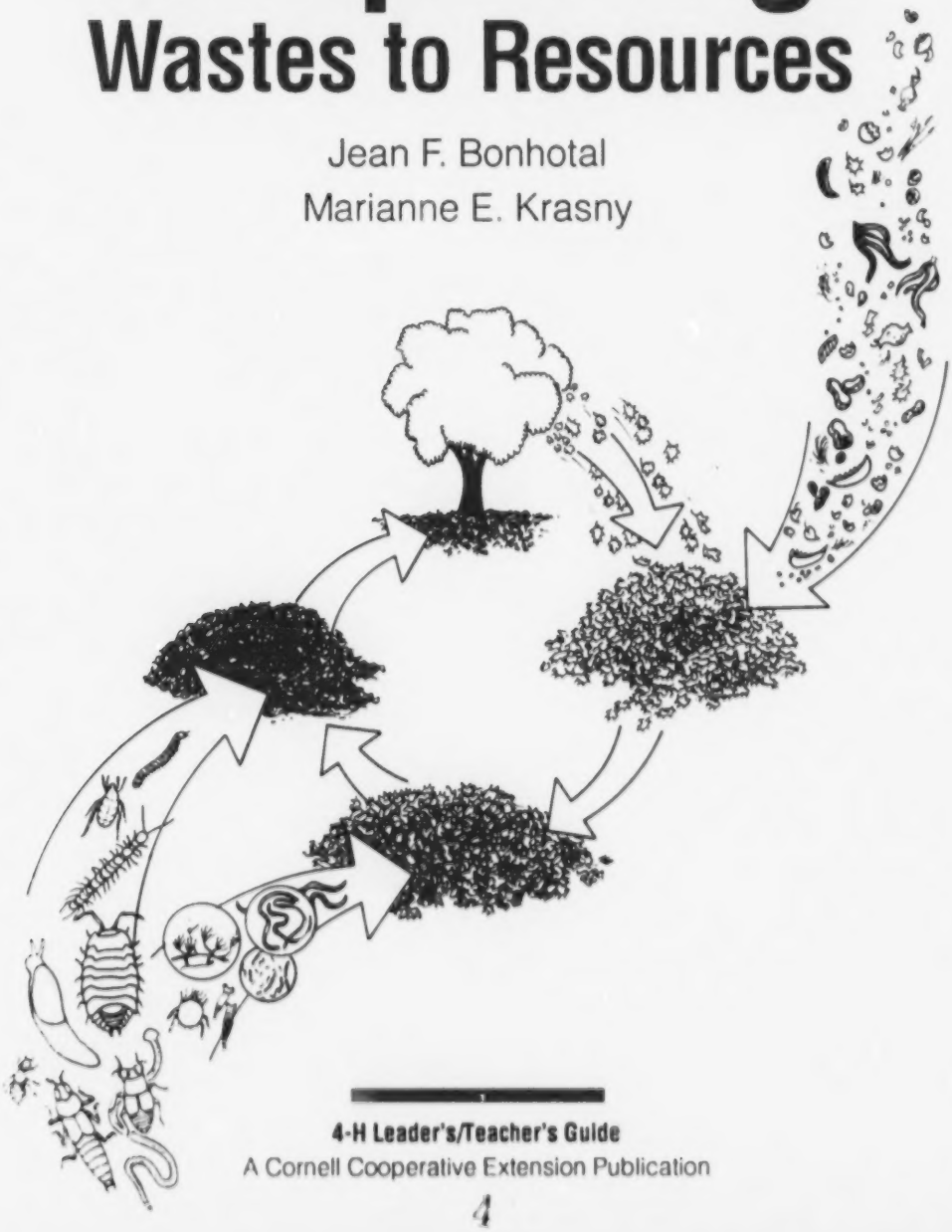
- Compost Mound
- Wire Mesh Bin
- Snow Fence Bin
- Cinder Block Bin
- Wooden Box Bin
- Cinder Block Turning Unit
- Wood and Wire Three-Bin Turning Unit
- Worm Composting Bin
- Garbage Can Composter
- Compost Pockets
- Mulch

EXPERIENCE

4-H NATURAL RESOURCES

Composting:
Wastes to Resources

Jean F. Bonhotal
Marianne E. Krasny



4-H Leader's/Teacher's Guide

A Cornell Cooperative Extension Publication

Composting: Wastes to Resources

Contents

Introduction 1

Getting Started 1

SECTION I
Welcome to Composting! 2
Best Ever Compost 5
How Does Composting Work? 9

SECTION II
Which Composting System Is for Me? 12
Composting Systems 13

SECTION III
My Compost Isn't Working! 16

SECTION IV
What Can I Do with My Compost? 18

SECTION V
Compost Investigations 19

SECTION VI
Glossary 34

SECTION VII
Finding Out More about Composting 35

Illustrations by Tamara Sayre

Jean F. Bonhotal is an extension support specialist for the Cornell Waste Management Institute.

Marianne E. Krasny is an assistant professor in the Department of Natural Resources, Cornell University.

This publication was developed to support 4-H programs in New York State.

The authors thank the following persons for their contributions to this publication: Robert E. Kozlowski, extension associate, Department of Floriculture and Ornamental Horticulture; and Thomas Richard, senior research support specialist, Nancy Dixon, environmental planner, and Howard Longhouse, lecturer, Department of Agricultural and Biological Engineering, Cornell University.

The authors also thank the Seattle Engineering Department and the Seattle Tilth Association for granting permission to Cornell Cooperative Extension to adapt the designs of their composting systems.

The illustration on page 24 is modified from Dindal, *Ecology of Compost. A Public Involvement Project.*

Introduction

Composting: Wastes to Resources is designed for adult volunteer leaders, camp counselors, and teachers who want to set up composting projects with youth. This guide explains what composting is and how it works and describes different composting systems. (Specific designs for building composting systems are included in your pocket folder.) Solutions to problems that may arise in composting are provided as well as suggestions about how to use your compost. The Compost Investigations and list of resources will help you and the youth in your group learn more about composting.

Getting Started

Interest is the first step in getting started on a project. As a leader planning to work with youth on a composting project, you are probably already interested in composting. If you work with youth who are concerned about environmental problems, particularly solid waste disposal, then it should be easy to get them involved. Youth who like to garden may also develop an interest in composting.

Knowledge is the second step in getting started on a project. We suggest you read Sections I through IV to learn more about composting. Then meet with your youth group and get them started. The two posters included in your pocket folder—"Best Ever Compost" and "How Does Composting Work?"—will help your group understand composting.

The youth in your group may want to work together to build a composting system, or each may want to build his or her own system. Once your group has decided which composting system(s) to build, provide the members with photocopies of the instructions in the pocket folder.

Sometimes a composting system doesn't work. Use Section III to prevent or identify and solve composting problems. Reinforce what your group has learned with the problem-solving exercise in that section, which can be copied and distributed.

After the youth in your group have made compost (or have partially finished compost), they can learn more about the composting process by conducting one or more of the investigations in Section V. The instructions and record sheet for each investigation can be copied and distributed. You can also provide copies of the Compost Project Record found in the pocket folder.

Good luck with your composting project!

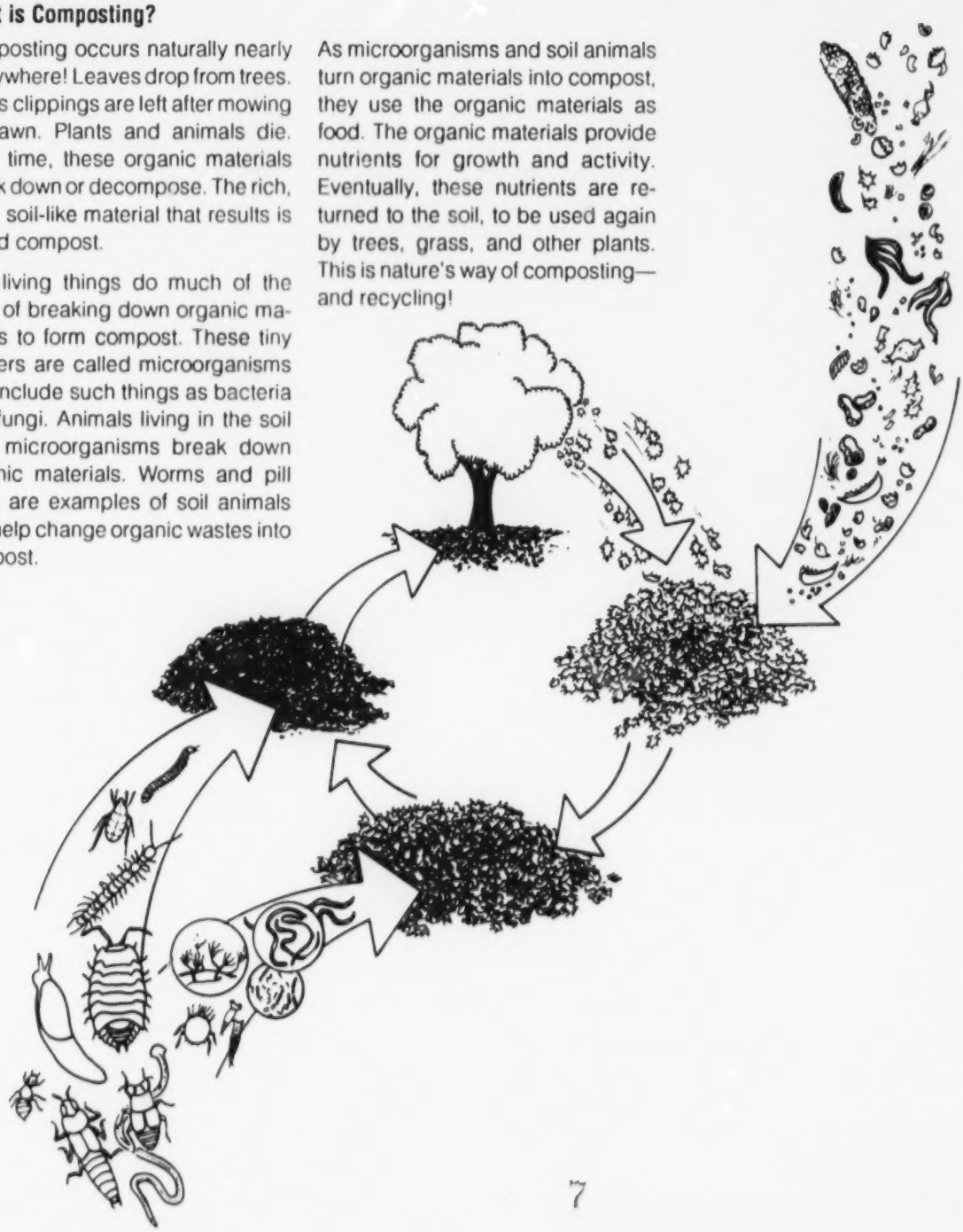
Section I
Welcome to Composting

What is Composting?

Composting occurs naturally nearly everywhere! Leaves drop from trees. Grass clippings are left after mowing the lawn. Plants and animals die. Over time, these organic materials break down or decompose. The rich, dark, soil-like material that results is called compost.

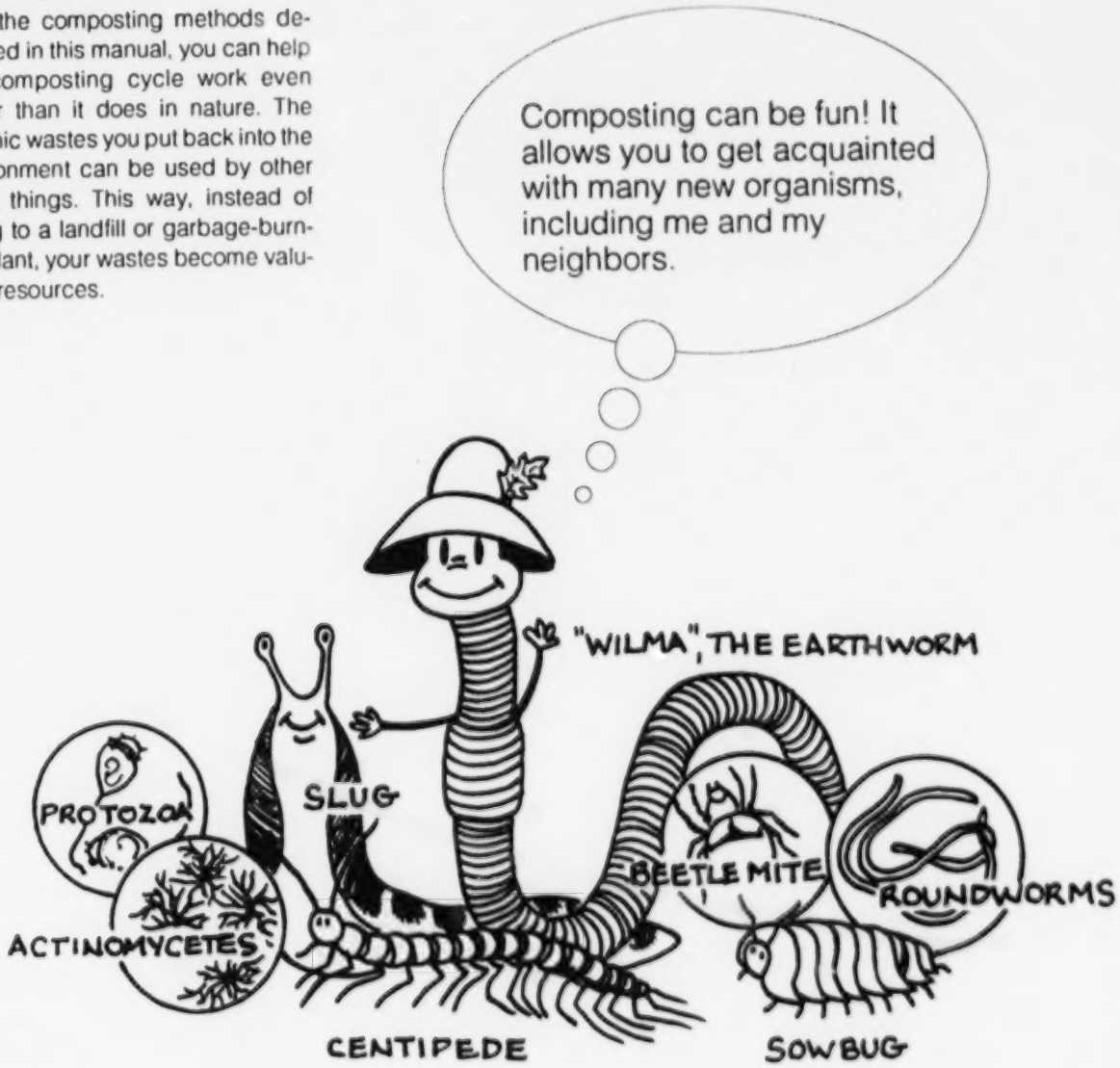
Tiny living things do much of the work of breaking down organic materials to form compost. These tiny workers are called microorganisms and include such things as bacteria and fungi. Animals living in the soil help microorganisms break down organic materials. Worms and pill bugs are examples of soil animals that help change organic wastes into compost.

As microorganisms and soil animals turn organic materials into compost, they use the organic materials as food. The organic materials provide nutrients for growth and activity. Eventually, these nutrients are returned to the soil, to be used again by trees, grass, and other plants. This is nature's way of composting—and recycling!



Why Compost?

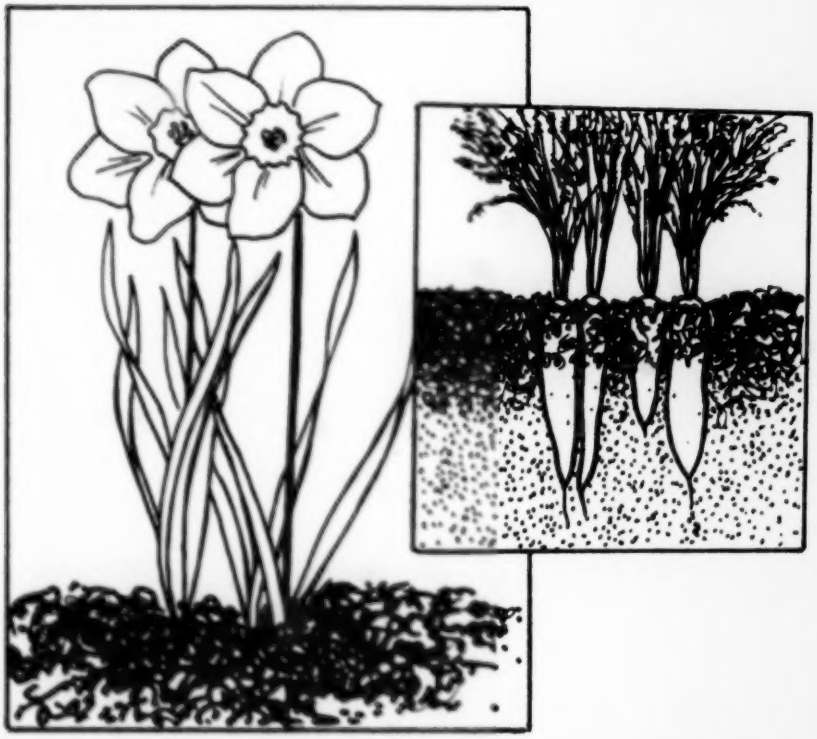
With the composting methods described in this manual, you can help the composting cycle work even better than it does in nature. The organic wastes you put back into the environment can be used by other living things. This way, instead of going to a landfill or garbage-burning plant, your wastes become valuable resources.



Reasons to Compost

Yard waste and food scraps make up 20 to 30 percent of garbage! Many landfills are filling up and closing. Finding places to put garbage is a big problem. By composting yard and kitchen wastes, you send less garbage to landfills.

Gardeners use compost. Compost allows the soil to hold more water and adds nutrients to the soil. Flowers, vegetables, trees, shrubs, house plants, lawns, and container gardens grow better in soil mixed with compost.



Best Ever Compost

Just Follow the Recipe!

Composting is like baking a cake. Simply add the ingredients, stir, "bake," and out comes—compost!

Whether you compost kitchen wastes or yard and garden wastes, there are a few basic steps to follow. Here are the necessary ingredients and general directions for composting.

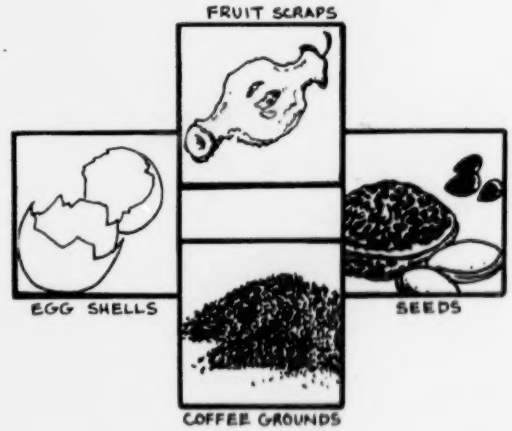
Ingredients

Kitchen Compost

Add a mixture of some or all of the following ingredients:

- vegetable peels and seeds
- fruit peels and seeds
- coffee grounds
- egg shells
- nut shells
- any other vegetable or fruit scraps

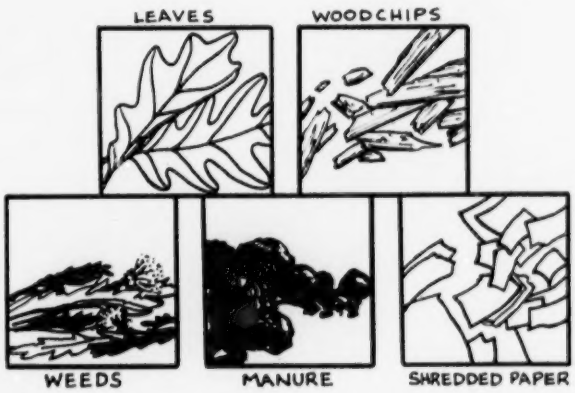
Note: (Do not add meat scraps, bones, dairy products, oils, or fat. They may attract pesty animals.)



Yard or Garden Compost

Add a mixture of some or all of the following ingredients:

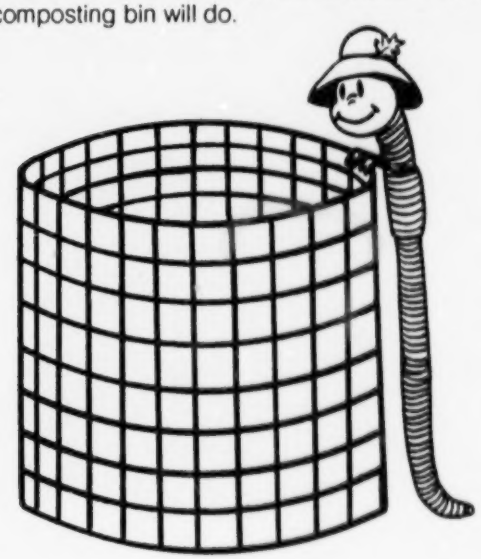
- hay or straw
- grass clippings
- leaves
- ashes
- sawdust
- wood chips
- weeds and other garden waste
- manure
- shredded paper



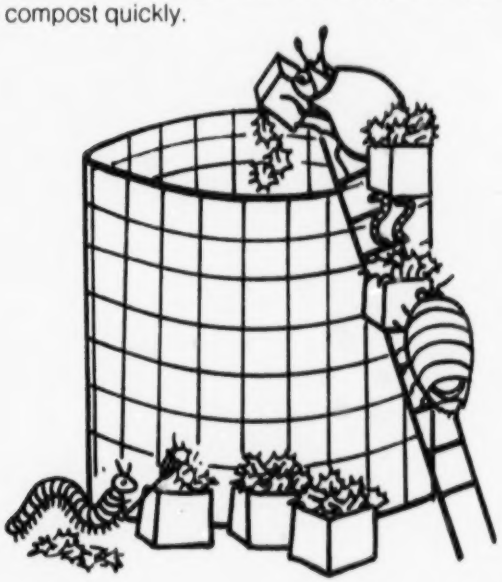
BEST COPY AVAILABLE

Directions

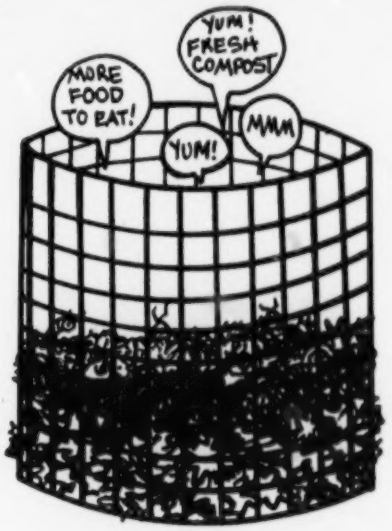
1. Choose a "pot" for baking your compost. Any type of composting bin will do.



2. Place kitchen or yard wastes into the composting bin. Chop or shred the organic materials if you want them to compost quickly.

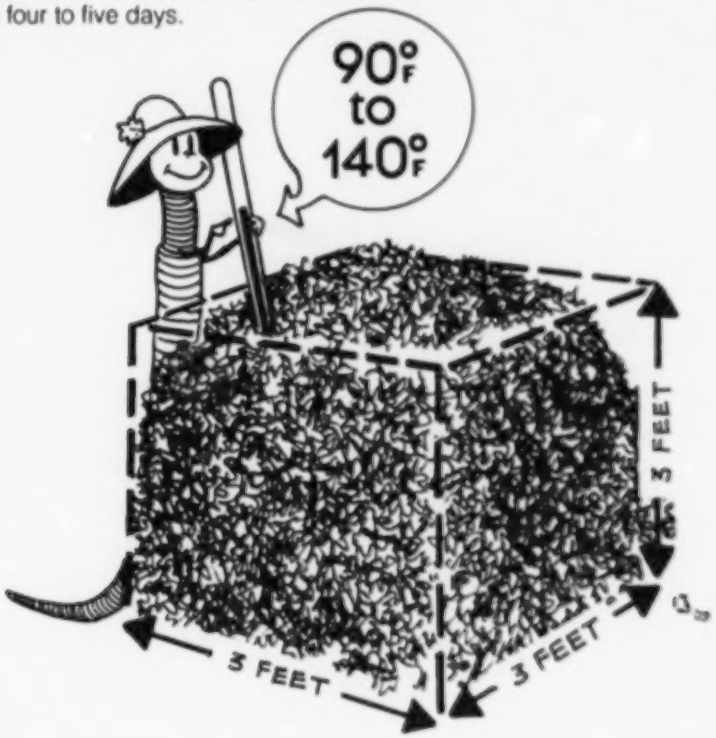


3. Spread soil or "already done" compost over the compost pile. This layer contains the micro-organisms and soil animals that do the work of making the compost. It also helps keep the surface from drying out.



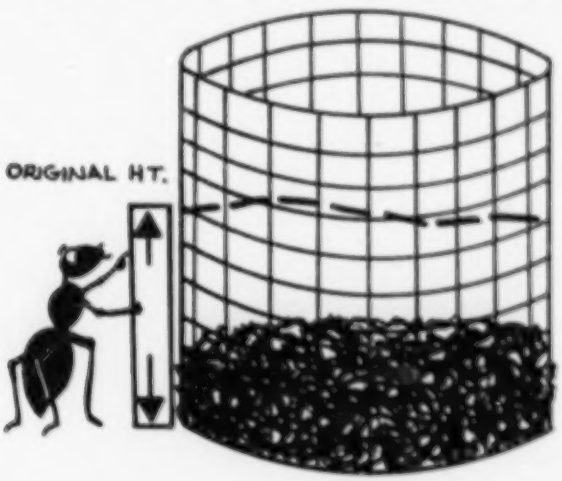
4. Adjust the moisture in your compost pile. Add dry straw or sawdust to soggy materials, or add water to a pile that is too dry. The materials should be damp to the touch, but not so wet that drops come out when you squeeze it.

5. Allow the pile to "bake." It should heat up quickly and reach the desired temperature (90° to 140°F, or 32° to 60°C) in four to five days.



6. Stir your compost as it bakes if you want to speed up the baking time.

7. The pile will settle down from its original height. This is a good sign that the compost is baking properly.



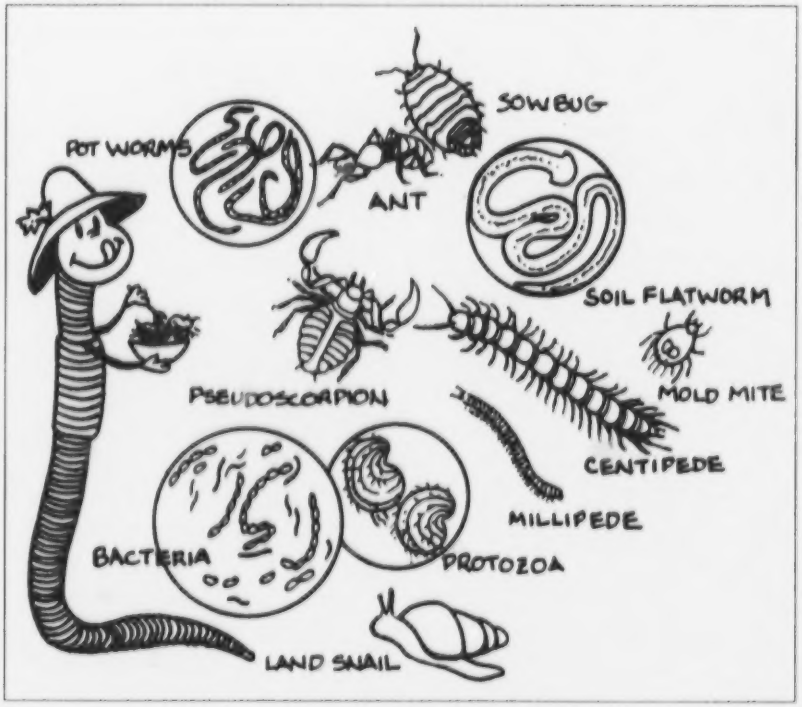
8. If you mix or turn your compost pile every week, it should be "done," or ready to use, in one to two months. If you don't turn it, the compost should be ready in about six to twelve months.

9. Your "best ever compost" should look like dark crumbly soil mixed with small pieces of organic material. It should have a sweet, earthy smell.

10. Feed compost to hungry plants by mixing it with the soil.

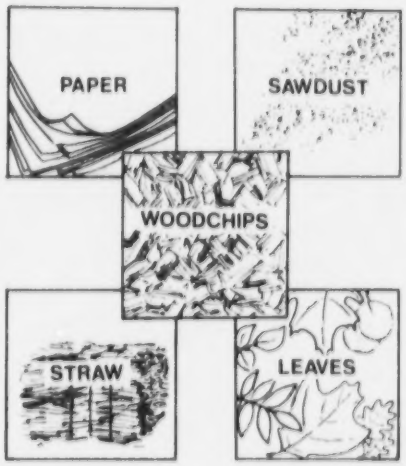
How Does Composting Work?

1. We are the key to composting. Normally, we live in the soil and eat small tidbits of organic matter such as leaves and twigs that nature hands out to us. We would like to have more to eat. A lot of the things that you call waste—for example, banana peels, rotten apples, brown wilted lettuce, fallen leaves, and weeds from your garden—are food for us.



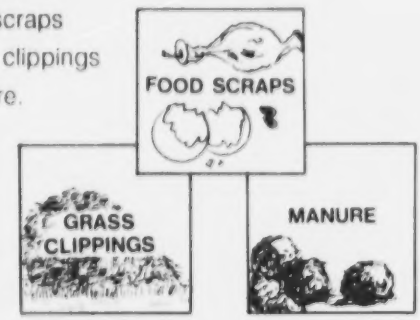
2. We need a balanced diet! We need carbon for energy and nitrogen to help build our bodies. Some of your wastes are high in carbon. These include

- paper
- sawdust
- wood chips
- straw
- leaves.



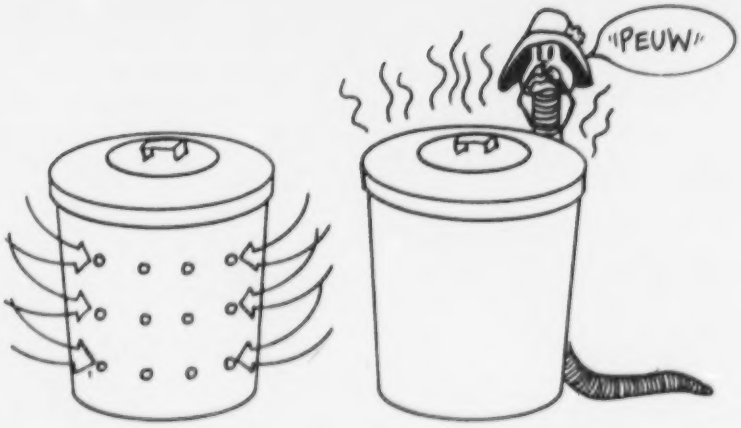
Other wastes are high in nitrogen. These include

- food scraps
- grass clippings
- manure.



Be sure to include a mixture of wastes high in carbon and wastes high in nitrogen in your compost pile.

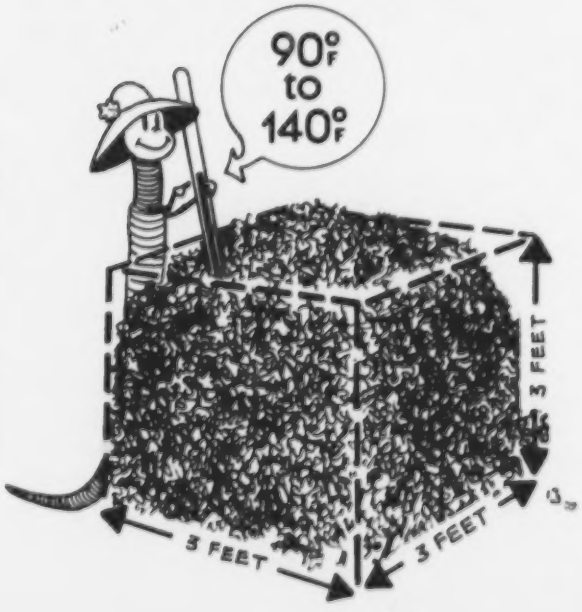
3. Don't smother us! We need air to survive. Be sure your compost container has holes in it to allow air to get into the compost pile. If possible, stir or turn your compost pile every week or so to let in more air. If we don't get enough air, many of us will die, and other microorganisms that don't need air will break down the wastes in your compost pile. These organisms give off a nasty smell and are slow workers. I think you'd prefer us in your compost pile!



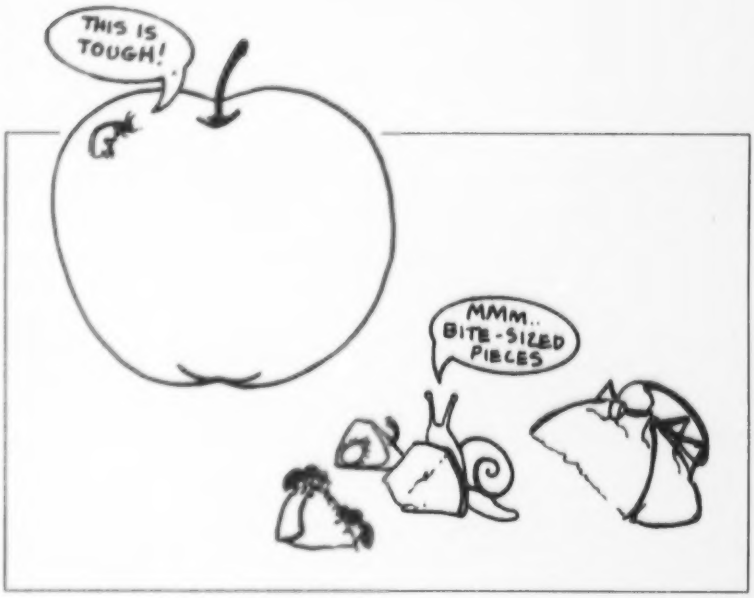
4. Don't let us dry out! We need water. Your compost pile should be about as moist as a sponge that has just been wrung out. If there is not much rainfall, add water to your compost pile.

5. Don't let us get cold! We like temperatures of 90° to 140°F (32° to 60°C). If the temperature is too cold in your compost pile, many of us will die, and other microorganisms that work more slowly than we do will come into your pile.

   If your compost pile is too small, we will feel the cold air coming in from the sides. The best way to keep us warm is to build a pile that is at least 3 feet x 3 feet x 3 feet (1 meter x 1 meter x 1 meter).



6. We must be able to get to our food! It is harder for us to eat large pieces of food than to eat small pieces of food. For example, if you throw a whole apple into your compost pile, only a few of us can eat it at a time. If you cut up your apple into small pieces, then a lot of us can get to it at once.



7. If you supply all these things—food, air, and moisture in a good-sized pile—we will be glad to make compost for you. Our job can take from six weeks to three years, depending on how you care for us. When we have completed our work, the compost will be ready to help your plants grow.

Section II
Which Composting System Is for Me?

There are many ways to compost wastes. Some methods need a backyard, and others can be used by apartment dwellers. The method of composting you choose will depend on whether you plan to compost yard wastes or kitchen wastes, how much money and time you wish to spend, how much room you have, and how soon you need the compost.

To determine which composting system is for you, first decide whether you will be composting yard and garden or kitchen wastes. Then read the brief comparisons of the different systems on the chart below. More information on each composting system follows.

System Used	*Cost*	*Time for Finished Compost (Rate of Composting)*
	Yard Waste	
Compost mound	None	Slow if not turned; fast if turned often
Holding unit	Low	Slow
Turning unit	High; lower if scrap and recycled materials are used for construction	Fast, minimum 6 weeks
Mulch	Low	Can use immediately, but material should be shredded
Commercial bin	High	Fast, minimum 2 weeks
	Kitchen Waste	
Compost pockets	None	Can use immediately
Garbage can composter	Low	Slow; faster if turned or mixed
Worm composting bin	Medium	Fast, minimum 4 weeks
Turning unit	High	Fast, minimum 6 weeks

Note: Kitchen and yard wastes can be composted together, but the combination may attract rodents.

Composting Systems

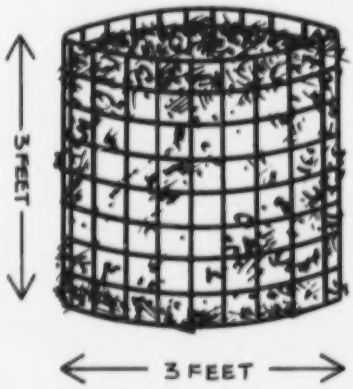
Wastes can be composted using any of a number of systems, from simple to elegant. The simplest designs are inexpensive and require relatively little work. The fancier systems—for example, a wood and wire turning unit or a worm composting bin—can cost $100 or more. They make excellent woodworking projects for youth.

The descriptions that follow are a brief introduction to the different types of composting systems. More detailed instructions on how to build particular composting systems or bins are in the pocket folder.

Holding Unit

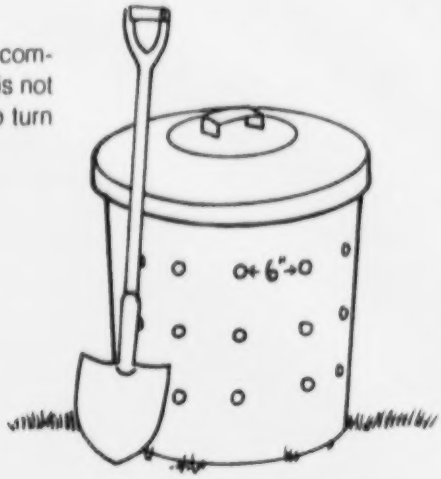
A holding unit can be any simple container that holds your yard and garden wastes while they break down. Once your holding unit is built, no other work is required except placing wastes into the container. Because the amount of air reaching the waste is not increased by turning, this method takes a relatively long time to produce compost—from six months to two years. You can speed up the process by chopping or shredding the wastes.

Nonwood materials such as grass clippings and garden weeds work best in a holding unit. These materials can be added continuously. Designs for four types of holding units are included in the pocket folder: a wire mesh bin, a snow fence bin, a cinder block bin, and a wooden box bin. You may want to design your own holding unit.



Garbage Can Composter

A garbage can can be used to compost food wastes. This system is not fancy, but it works. It is best to turn your wastes with this method.

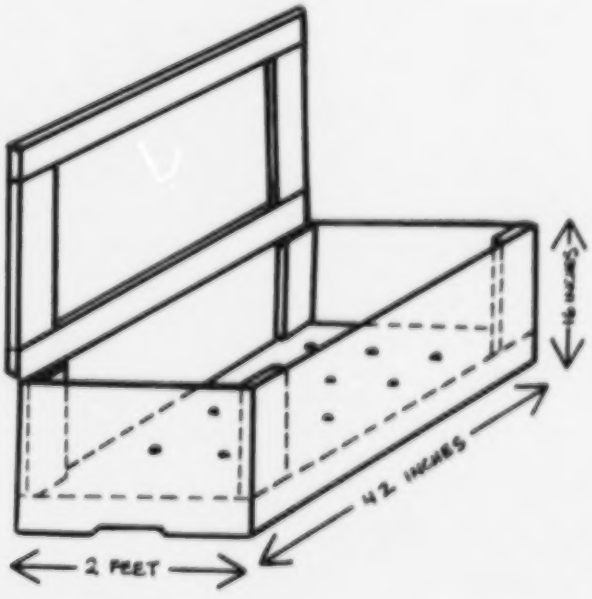


Mulch

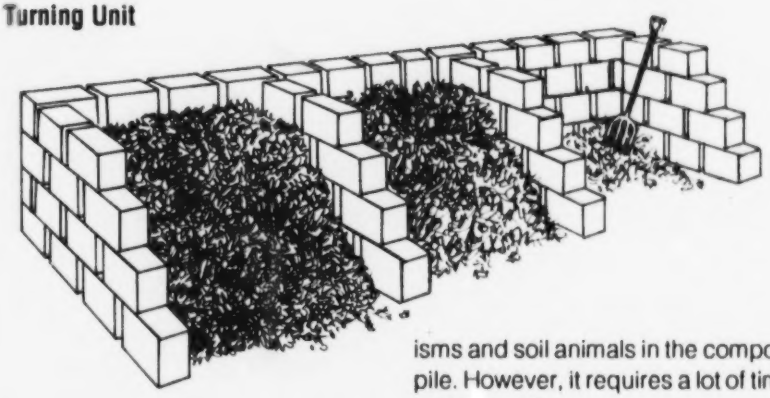
Mulch is placed on top of the soil in gardens or around trees to suppress weeds, keep soil moist, keep plant roots cool in summer and warm in winter, and prevent soil from washing away or becoming hard. Yard wastes can be used as mulch and placed around plants in the garden or along paths and in play areas. The only costs are your time and work. You can also mulch with compost made using one of the methods described in this manual.

Worm Composting Bin

A worm composting bin, if built with care, can look quite elegant and can even be used as a bench. After you have built the bin, provided bedding, and located a source of worms, a worm bin requires relatively little maintenance. Simply add kitchen wastes as they become available.



Turning Unit



A turning unit looks like three holding units placed side by side. While the compost in one bin is "cooking," you add wastes to the empty bin right next to it. As you might have guessed from its name, in a turning unit the wastes are stirred or turned every week or so. This speeds up the composting process by allowing more air to reach the microorganisms and soil animals in the compost pile. However, it requires a lot of time and energy!

You can use a turning unit for either yard or kitchen wastes. If you plan to compost food scraps, be sure to build a unit that prevents nuisance animals from getting to the wastes.

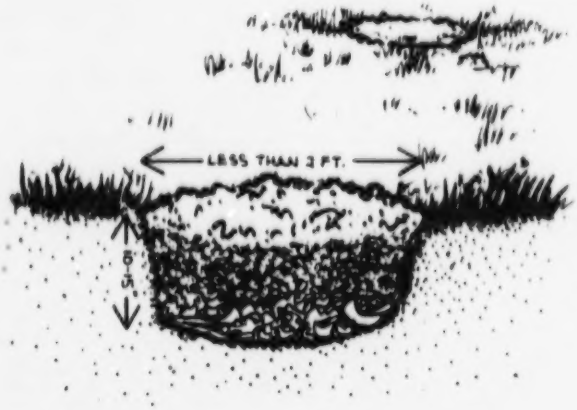
When putting wastes in a turning unit, do not add too much of any one material at a time. This is important because the microorganisms in the turning unit need a variety of nutrients. Either add thin layers of different kinds of organic materials or mix your wastes together.

When the microorganisms in a turning unit have the right mixture of nutrients and enough air, they work very quickly and give off a lot of heat. The organic materials in a turning unit can heat up to about 150°F (66°C). If you turn your compost pile as the temperature starts to drop, the microorganisms get more air and a new mixture of materials. They start working very hard again, and your pile heats up. Keep turning your pile until the compost is ready. A "hot" pile makes compost in about one month.

You can design and make your own turning unit by using either cinder blocks or wood to build three holding units right next to each other (see the instructions in the pocket folder).

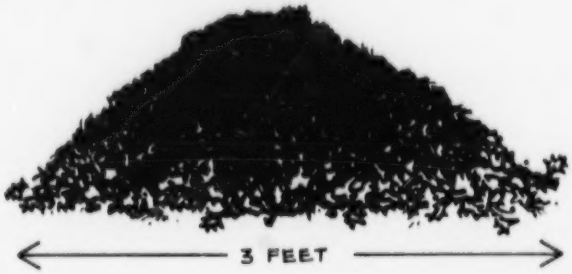
Compost Pockets

This method also doesn't require building a bin. You simply bury your wastes in the ground.

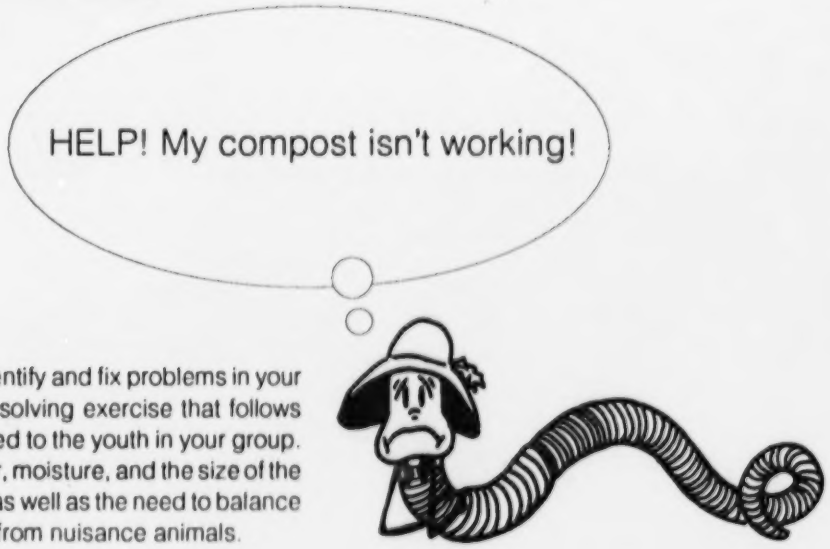


Compost Mound

A compost mound doesn't require a bin—you just pile your organic wastes in a mound.



Section III
My Compost Isn't Working



Use the following chart to identify and fix problems in your compost pile. The problem-solving exercise that follows can be copied and distributed to the youth in your group. It shows the importance of air, moisture, and the size of the pile when making compost, as well as the need to balance wastes and protect the pile from nuisance animals.

Symptom	*Problem*	*How to Fix It*
Pile is wet and smells like a mixture of rancid butter, vinegar, and rotten eggs	Not enough air	Turn pile
	Or too much nitrogen	Add straw, sawdust, or wood chips
	Or too wet	Turn pile and add straw, sawdust, or wood chips; provide drainage
Pile doesn't heat up	Pile is too small	Make pile larger
	Or pile is too dry	Add water
Pile is damp and sweet smelling but will not heat up	Not enough nitrogen	Add grass clippings or other sources of nitrogen
Center is dry and contains tough materials	Not enough water	Add water and turn
Pile is attracting animals	Meat and other animal products have been added	Keep meat and other animal products out of the pile; enclose pile in 1/4-inch hardware cloth

Solving Problems in Your Compost Pile

Name: _____

Date: _____

How might you solve these compost problems?

1. My compost pile isn't warming up. I should

2. My neighbor has a compost pile that smells like rotten eggs. She should

3. Our school compost pile seems too wet. We should

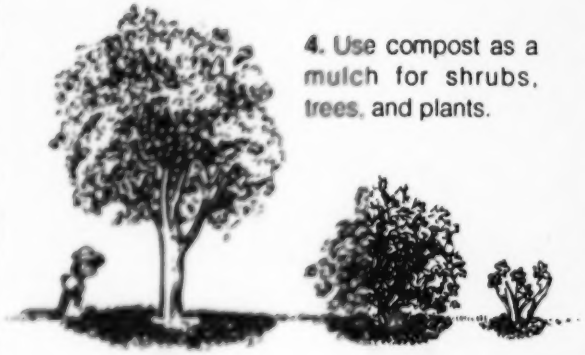
Section IV
What Can I Do with My Compost?

1. Spread compost on your garden before rototilling or turning the soil in the spring. Then mix the compost into the soil while rototilling or turning.

2. Place or bury compost in your garden between plant rows. The plant roots will grow into the compost and take up the nutrients.

3. In flower gardens, dig in compost around the plants.

4. Use compost as a mulch for shrubs, trees, and plants.

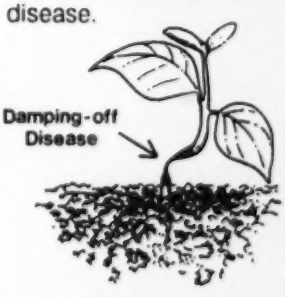


5. When transplanting house plants, add compost to the soil.

6. Use your compost for some of the Compost Investigations in Section V of this guide.

Composting Don't

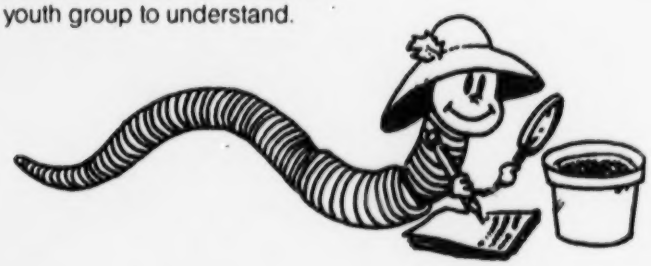
Don't use compost to sprout tender seeds. The seeds may be killed by a fungus in the compost that causes damping-off disease.



BEST COPY AVAILABLE

Section V
Compost Investigations

Each compost investigation included in this section covers one or more "compost concepts." Following is a list of the investigations and concepts. Choose one or more of the investigations, depending on which concepts you think are important for your youth group to understand.



Investigations	*Concepts*
How Hot Is My Compost?	Importance of air
Discover Composting Microorganisms	Importance of microorganisms
Discover Compost Animals	Importance of soil animals Compost food chains
Watching Wastes Rot I	Importance of organisms that break down wastes Biodegradable and nonbiodegradable wastes
Watching Wastes Rot II	Importance of air and size of wastes
Growing Plants with Compost	Wastes to resources

How Hot Is My Compost?

When your compost pile is working ideally, it will get hot. The temperature can rise to 150°F (66°C) during the composting process. In the winter, if the compost is working fast, snow will melt on the pile and you may even see water vapor coming off the top. The center of the pile will be warm to the touch.

Turning your compost pile adds air to the pile. Because the microorganisms and soil animals in the pile need air to do their work, turning the pile increases their activity. What effect does turning the compost pile have on its temperature?

What You Need

- candy or meat thermometer
- work gloves
- record sheet
- pencil

What to Do

As your compost pile works, take its temperature. Wearing a glove, place the thermometer deep into the center of the pile. Record the temperature on the Compost Temperature Record.

Compost Temperature Record

Name: _____

Date compost pile started: _____

Today's date: _____

Date last turned: _____

Temperature (°F or °C): _____

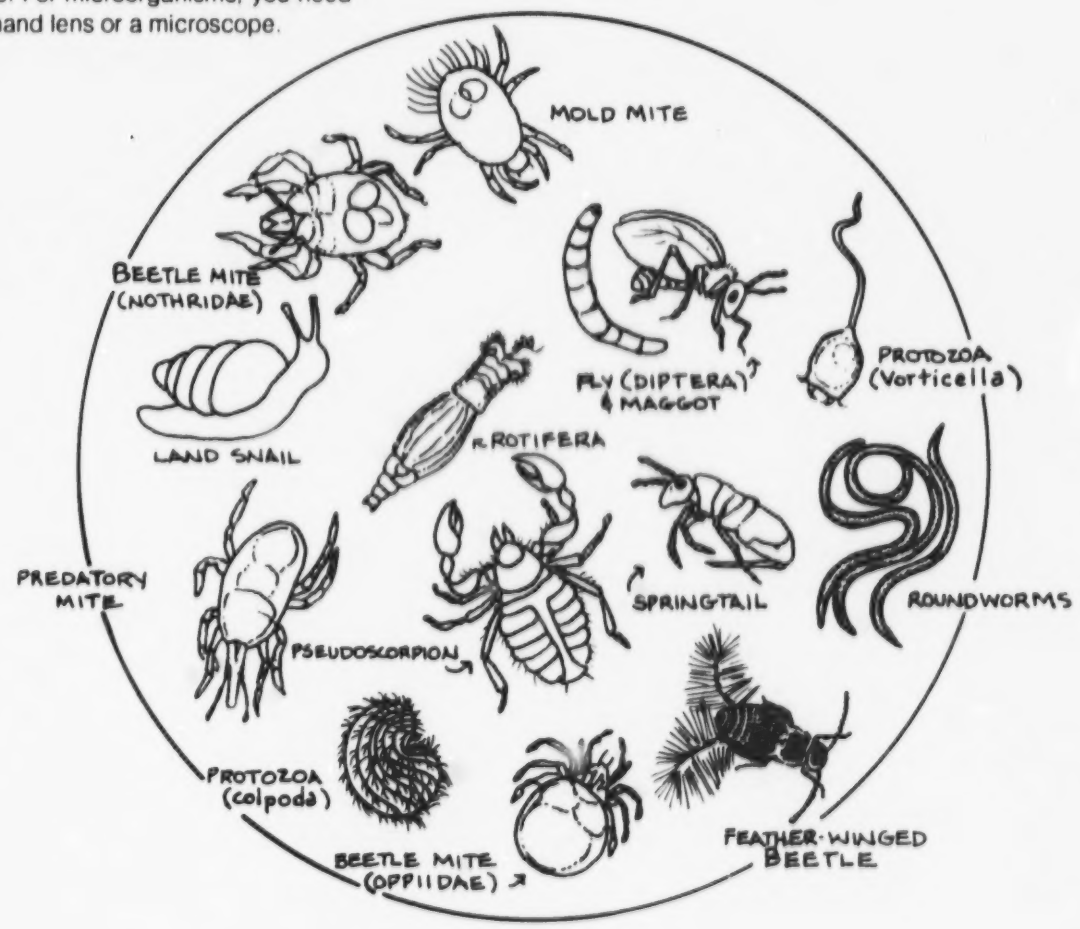
Observations (smell, color of material):

What effect did turning the pile have on its temperature?

What effect does turning have on the speed of breaking down material in a compost pile? Why?

Discover Composting Microorganisms

The insects, worms, bacteria, and fungi found in your compost pile do the work of composting. You can see some soil animals with the naked eye. For microorganisms, you need a hand lens or a microscope.



What You Need

- sample of compost
- glass slide
- hand lens or microscope
- record sheet
- pencil

What to Do

Put a compost sample on a glass slide with a drop of water. Observe the sample under a hand lens or microscope. Draw pictures of what you see. If possible, identify the organisms you see.

Discover Composting Microorganisms Record

Name: _____

Date: _____

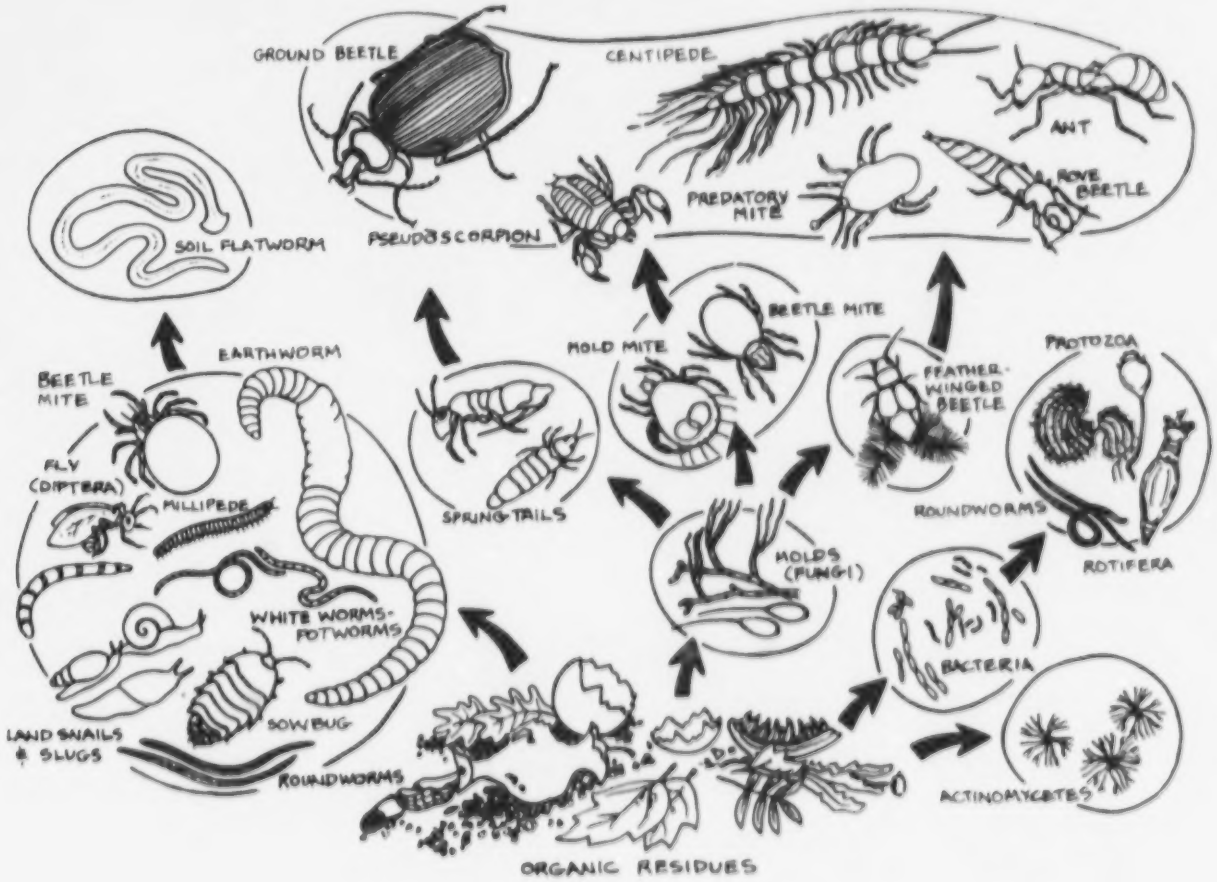
Draw pictures of the microorganisms that you see in your compost sample.
Can you name any of the organisms?

Discover Compost Animals

Microorganisms and soil animals, such as worms and insects, break down the organic material in your compost pile to form compost. But many other animals that don't eat wastes also live in your compost pile.

What do these animals eat? They eat the microorganisms and animals that break down the compost! Still other animals eat the animals that eat the microorganisms and animals that eat the organic wastes.

A food web is a group of organisms that feed on or are eaten by each other. Here is a diagram of the food web in your compost pile.



Would you like to observe some of the animals that live in your compost pile in person? You can do so by making an insect trap called a Berlese funnel.

What You Need

- small piece of window screen
- large diameter funnel
- small jar with soapy water
- container to hold funnel (a small plastic bucket will work)
- compost sample
- light source
- hand lens or dissecting microscope
- record sheet
- pencil

What to Do

Cut the screen to the diameter of the funnel about two-thirds of the way down from the top of the funnel. Place the screen into the funnel.

Fill the jar half full with soapy water. Put the jar in the bottom of the container.

Put the funnel with screen into the container so that the bottom of the funnel is suspended above the jar with soapy water.

Put the compost sample into the funnel.

Place the light source over the top of the funnel. Leave for several hours or overnight. The soil animals will crawl away from the light source to the bottom of the compost in the funnel. Then they will fall into the soapy water and die.

Pour the excess soapy water out of the jar. Observe the soil animals with the naked eye, under a hand lens, or with a dissecting microscope. Do you recognize any of the animals from the diagram of the compost food web? Record your observations.

Discover Compost Animals Record

Name: _____

Date: _____

Draw a picture of the animals that you see in your compost sample.

Can you name any of the animals? The picture on page 24 will help you.

What role do these animals play in the food web?

Watching Wastes Rot I

Some wastes break down faster than others in a compost pile. Some materials never break down in a compost pile.

Microorganisms and soil animals do most of the work of breaking down wastes in compost. Do you think wastes will break down if these organisms are not present? How long will it take?

What You Need

- flower pots
- compost sample
- sterile potting soil, perlite or vermiculite (sterile mix)
- organic wastes, such as orange peels and apple cores
- paper wastes, such as paper napkins and paper bags
- plastic wastes, such as styrofoam chips and plastic bags
- labels that stick on the pots
- record sheet
- pencil

What to Do

Fill half the flower pots half full with compost. Fill the other half of the pots half full with sterile mix.

Gather your organic, paper, and plastic wastes. Place one-half of each waste in a pot with compost and the other half in a pot with sterile mix. For example, place one apple core in a compost pot and one apple core in a sterile pot. Place three styrofoam chips in another compost pot and three styrofoam chips in another sterile pot. Label the pots with the names of the wastes.

Cover the wastes with compost or sterile mix, filling the pots. Add water to all the pots so that the compost and sterile mix are damp but not wet to the touch. Check your pots every few days to be sure they are still moist.

After one week, examine the wastes in each pot. Which wastes are decomposing? Cover the wastes again, and continue to check them once a week for as long as you want. Record your observations.

Compost Sterile mix

Watching Wastes Rot I Record

Name: _____ Date experiment started: _____

Fill in the following table each time you check your pots. Under "Waste," write the name of the item that you buried in the pot. Under "Compost," describe the condition of the item buried in compost each time you check it. Include such things as how decomposed the item looks, what color it is, and whether or not you see fungi (spots or thin strands) on it. Under "Sterile Mix," describe in the same way the condition of the item buried in sterile mix.

Date: _____ Time since waste was buried: _____

	Waste	*Compost*	*Sterile Mix*
1.	_____	_____	_____
		_____	_____
		_____	_____
2.	_____	_____	_____
		_____	_____
		_____	_____
3.	_____	_____	_____
		_____	_____
		_____	_____
4.	_____	_____	_____
		_____	_____
		_____	_____
5.	_____	_____	_____
		_____	_____
		_____	_____

Which items decomposed most quickly?

Which items didn't decompose at all?

In general, did items decompose more quickly in compost or in sterile mix? Why do you think this is true?

Watching Wastes Rot II

The organisms in a compost pile need air. When there is not enough air, the organisms die. New organisms that can survive without air come into the compost pile. These new organisms produce a gas that has a nasty smell.

The organisms in a compost pile also need to be able to get at the wastes to break them down. Is it easier for the organisms to get at large pieces of waste or small pieces?

Let's investigate how long it takes to break down wastes in the presence and absence of air. Let's also see how long it takes to break down wastes of different sizes.

What You Need

- wide-mouth jars
- compost sample
- organic wastes (you may use one or several kinds of wastes)
- flower pots
- labels for jars and pots
- record sheet
- pencil

What to Do

Fill two wide-mouth jars half full with compost. Place equal amounts of a particular waste in each jar. Then fill the rest of both jars with compost, burying the waste. Fill the first jar with water and place a lid on the jar. Add just enough water to the second jar so the compost is damp but not wet to the touch. Leave the second jar exposed to air. (Check on the second jar every few days to make sure the compost is still moist, but do not overwater.)

Repeat the procedure with other wastes. Label each jar with the name of the waste placed in it.

Take two more equal portions of a particular waste. Cut the first portion into small pieces. Leave the second portion uncut. Fill two flower pots half full with compost. Place the cut-up waste in the first pot and the uncut waste in the second pot. Cover the wastes with compost, filling the pots. Add water to the pots so that the compost is damp but not wet to the touch. Check your pots every few days to be sure they are still moist, but do not overwater.

Repeat the procedure with other wastes. Label each pot with the name of the waste placed in it and whether the waste is cut up or uncut.

Check your wastes after two weeks. Which wastes are decomposing? Record your observations.

Watching Wastes Rot II Record

Name: _____

Date: _____ Date experiment started: _____

Fill in the following table. Under "Waste," write the name of the item that you buried in the jar or pot. Under "Compost," describe the condition of the item buried in the compost. Include such things as how decomposed the item looks, what color it is, and whether or not you see fungi (spots or thin strands) on it.

	Waste	*Exposed to Air (yes or no)*	*Compost*
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____

	Waste	*Cut/ Uncut (C or U)*	*Compost*
1.			
2.			
3.			
4.			
5.			

Did items decompose faster in the jar with air or the jar with water?

Was there a smell coming from either jar? If yes, what caused the smell?

Were items more decomposed when they were cut up or uncut? Why?

Growing Plants with Compost

See how your garden grows! Adding compost to the soil can increase the soil's ability to hold water. In addition, compost can add nutrients to the soil. This helps the plants in your garden to grow.

On the other hand, it is difficult for seeds to sprout in pure compost. In fact, sensitive seeds may even be killed by a fungus if you try to sprout them in compost. This problem occurs mostly when the organic material is not completely broken down.

Let's do an experiment to see if adding compost to the soil has an effect on the sprouting of seeds and the growth of plants.

What You Need

- flower pots or cups with drainage holes
- gravel for drainage
- compost
- perlite
- seeds (bean, pea, radish, or lettuce seeds work well)
- colored toothpicks
- record sheet
- pencil

What to Do

Put one inch (2.5 cm) of gravel in the bottom of each of the flower pots. Label the pots 1 to 4.

Add compost only to pot 1.

Using a measuring cup or other plastic cup, measure one part compost and an equal amount of perlite. Mix the compost and perlite together thoroughly. Fill pot 2 with this 1-to-1 compost-to-perlite mixture.

Using a measuring cup or other plastic cup, measure one part compost and three parts perlite. Mix the compost and perlite together thoroughly. Fill pot 3 with this 1-to-3 compost-to-perlite mixture.

Fill pot 4 with 100 percent perlite.

Plant three to four seeds of the same species in each pot. Bean seeds are fast growing and easy to observe, but many seeds will do.

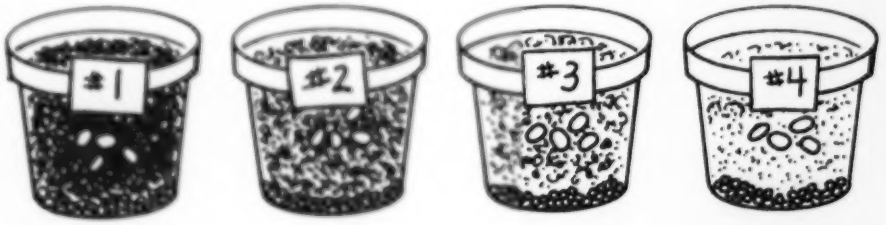
Water your seeds following the instructions on the package. Make sure you add the same amount of water to each pot.

After four or five days, your seeds should have sprouted. Count the number of seeds that have sprouted in each of the four pots. Record the number of seeds that have sprouted on your Growing Plants with Compost Record. Then thin extra plants so you have one plant in each pot.

Follow the growth of your plants for four to five weeks. Once a week, measure the height of the plant in each pot. Record the height of the plants on your Growing Plants with Compost Record. Note if any plants die.

After five weeks, count the number of surviving plants. Compare the number of surviving plants in the different mixtures of compost and perlite. Then measure the height of the plants.

Note: To be more scientific, you may want to have more than one pot for each of the four compost "treatments."



Growing Plants with Compost Record

Name: _____ _____

Plant species: _____ _____ Date planted: _____

Sprouting

Date	*Pot number*	*Number of seeds sprouted*

Growth

Date	*Pot number*	*Plant*	*Height*

Summary

What effect did the compost have on the sprouting of the seeds? Why?

What effect did the compost have on the growth of the plants? Why?

Section VI
Glossary

Actinomycetes. Microorganisms that have the characteristics of both fungi and bacteria. Actinomycetes create cobweb-like growths throughout the compost and give compost an earthy aroma.

Bacteria. In a compost pile, the microorganisms that do most of the work to decompose wastes. Hard-working bacteria cause the compost pile to heat up. Under a microscope, bacteria look like small round or rod-shaped organisms.

Carbon. An element that is abundant in wood chips, sawdust, straw, and leaves. Carbon provides energy for living things.

Celsius (C). A temperature scale in which 0° is freezing and 100° is boiling. [Degrees in Celsius = 5/9 x (degrees in Fahrenheit - 32)]

Compost. A rich soil-like mixture that is produced when organic materials break down.

Compost mound. A pile of yard, garden, or kitchen wastes that is not contained by a bin; the wastes take 6 months to 2 years to break down, depending on the amount of turning.

Compost pocket. A small hole in the ground containing yard, garden, or kitchen wastes that are buried in small amounts and left to break down.

Composting. Converting organic wastes into a rich soil-like material.

Composting system. The method used to convert organic wastes into compost (e.g., a compost mound, a compost pocket, a holding unit, or a turning unit).

Damping-off disease. A plant disease caused by a fungus that damages plant roots; the damping-off disease fungus is found in soils and compost and may cause young plants to die.

Decompose. To break down or rot.

Fahrenheit (F). A temperature scale in which 32°F is freezing and 212°F is boiling. [Degrees in Fahrenheit = (9/5 x degrees in Celsius) + 32.]

Fungi. Organisms such as molds, yeast, and mushrooms that feed on dead organic matter.

Holding unit. A simple container that holds yard, garden, and kitchen wastes while they break down.

Invertebrate. An animal without a backbone, such as an insect or worm.

Kitchen wastes. Food scraps, such as potato peels, apple cores, moldy food, and wilted lettuce.

Microorganism. A tiny living thing that is so small you need a microscope or magnifying glass to see it. Microorganisms help break down organic wastes.

Millipede. A tiny worm-shaped animal with many pairs of legs. Millipedes live in soil and compost.

Mite. A tiny animal, no bigger than a pinhead, that lives in soil and compost.

Mulch. A covering, such as leaves, straw, peat moss, or compost, that is placed on top of the soil in gardens and around trees. Mulch suppresses weeds, keeps soil moist, and keeps plant roots cool in summer and warm in winter.

Nitrogen. An element that is found in food scraps, grass clippings, and manure. Nitrogen is used by living things for growth.

Nutrient. A food ingredient that supplies energy for living and growth.

Organic material. Matter that has come from living things (plants and animals).

Perlite/vermiculite. A lightweight material that is used for starting plant seeds.

Pill bug. A small animal that lives in moist soil and rolls up in a little ball when it is threatened or scared.

Potworm. A small worm that lives in soil and compost.

Roundworms (also known as **nematodes**). The most abundant invertebrates in the soil. These small worms (less than one centimeter) prey on fungal spores, protozoa (a type of microorganism), and each other and are very good for compost.

Solid waste. Household trash, yard and kitchen wastes, old machinery and equipment, and many agricultural and industrial wastes—items that people throw out.

Turning. In a compost pile, mixing and moving the organic material.

Turning unit. Three holding units built next to each other. After compost has been in one bin long enough to start breaking down, it is turned into the next bin. Wastes from the top and sides are put on the bottom and middle, and wastes from the bottom and middle are put on the top and sides. This way, more air reaches the compost and it breaks down quickly. New wastes are added to the empty bin rather than to compost that is already started.

Yard and garden wastes. Grass clippings, dead leaves, small branches, and weeds.

Section VII
Finding Out More about Composting

To find out more about composting, you will want to read the following publications.

Appelhof, Mary. 1982. *Worms Eat My Garbage*. Kalamazoo, Mich.: Flower Press.

Cobb, Vicki. 1981. *Lots of Rot*. New York: J. B. Lippincott Junior Books.

Cornell Waste Management Institute, 1988. Composting. (A three-panel display and accompanying fact sheet on composting. True/false questions wired to light up when questions are correctly answered.) Ithaca, N.Y.: Cornell Cooperative Extension. (Available on loan from Cornell University Distribution Center, 7 Cornell Business and Technology Park, Ithaca, NY 14850.)

Dickson, Nancy, Thomas Richard, Robert Kozlowski, and Roger Kline. 1990. *Home Composting Guide*. Ithaca, N.Y.: Department of Agricultural and Biological Engineering, Cornell University. In press.

Dindal, Daniel. 1972. *Ecology of Compost: A Public Involvement Project*. Syracuse, N.Y.: Office of Public Service and Continuing Education, State University of New York, College of Environmental Science and Forestry.

Hallowell, Ann, Carrie Morgan, John Reindl, Dan Sivek, Larry Sperling, and Dennis Yockers. 1988. *Recycling Study Guide*. PUBL-IE-020 87. Wisconsin Department of Natural Resources.

International Process Systems, Inc. 1987. *Compost Facts*. Lebanon, Conn. (Available from International Process Systems, Inc., Lebanon, CT 06249, 203/642-6670.)

MacDaniels, L.H., and R. E. Kozlowski. 1985. *Compost for the Home Garden*. Ithaca, N.Y.: Cornell Cooperative Extension. (141HGFS 700.00. Available from Cornell University Distribution Center, 7 Cornell Business and Technology Park, Ithaca, NY 14850).

Michigan State University Extension. *Backyard Composting*. East Lansing, Mich.: Cooperative Extension Service (WM02).

Michigan State University Extension. *Municipal Yard Waste Composting*. East Lansing, Mich.: Cooperative Extension Service (WM04).

Richard, Thomas. 1988. *Home Composting Educational Materials List*. Ithaca, N.Y.: Cornell Waste Management Institute. (A listing of resource materials.)

Richard, Thomas, and Nancy Dickson. 1990. *Yard Waste Composting: A Planning Guide*. Ithaca, N.Y.: Department of Agricultural and Biological Engineering, Cornell University. In press.

Richard, Thomas, and Nancy Dickson. 1990. *Yard Waste Composting: Operations Manual*. Ithaca, N.Y.: Department of Agricultural and Biological Engineering, Cornell University. In press.

Strom, Peter S., and Melvin S. Finstein. 1986. *Leaf Composting Manual for New Jersey Municipalities*. New Brunswick, N.J.: Department of Environmental Protection.

Woestendiek, Carl, Craig H. Benton, Jeffrey P. Gage, and Howard Stenn. 1987. *Master Composter Resource Manual*. Seattle, Wash.: Community Composting Education Program, Seattle Tilth Association and Seattle Engineering Department's Solid Waste Utility.

Cornell Cooperative Extension 4-H Natural Resources Publications

Fisheries and Aquatic Resources

Basic Fly Tying. Available from Media Services. 147L-5-5, $1.65, 19 pages.

Exploring Freshwater Fisheries. Available from Media Services. 147L-5-7, $2.50, 24 pages.

Let's Go Fishing. Available from Media Services. 147L-5-6, $2.00, 33 pages.

Let's Go Ice Fishing. Available from Media Services. 147L-5-15, $1.75, 20 pages.

Sportfishing and Aquatic Resources Education Program (SAREP) Fishing Journal. Available from DNR, $1.00.

Sportfishing and Aquatic Resources Education Program (SAREP) Leader's Manual. Available from DNR, $40.00, 245 pages.

Sportfishing and Aquatic Resources Education Program (SAREP) Member's Manual. Available from DNR, $2.50, 161 pages.

Water Wise: Lessons in Water Resources. Available from DNR, $4.00, 87 pages.

Water Worlds. Available from Media Services. 147L- and M-5-18, $5.35.

Forestry

Backyard Maple Syrup. Available from Media Services. Conservation Corner Leaflet 13, 147CIRL-13, $0.50.

Firewood: From Woodlot to Woodpile. Available from Media Services. 147L-5-12, $2.00.

4-H Wood Sample Collection. Available from Media Services. 147M-5-3A, $0.50.

Know Your Trees. Available from Media Services. 147L-5-3 (Leader's Guide and Checklist), $2.00, 71 pages ; 147J-85 (Member's Project Guide) and 147M-5-3 (Member's Record Book), $0.50.

Nature Trails Development. Available from Media Services. 147L-5-4, $1.00, 24 pages.

Understanding Forest Ecosystems. Available from Media Services. 147L-5-13, $2.25, 42 pages.

Wildlife

Birds in Your Backyard. Available from Media Services. 147L- and 147M-5-17, $5.90.

Birds of Prey. Available from Media Services. 147L-5-9, $3.25, 28 pages.

Bluebirds in New York. Available from DNR, $2.00, 27 pages.

4-H Shooting Sports Notebook. Available from Cornell Cooperative Extension county offices. 204 pages.

Understanding Predation and Northeastern Birds of Prey. Available from Media Services. 147-IB-175, $4.25, 48 pages.

Understanding Wildlife Signs. Slide set. Available from Instructional Materials Services. Set includes 35 slides, with script and cassette.

Wildlife Discovery. Available from Media Services. 147L- and 147M-5-19, $8.25.

Wildlife Habitat Enhancement. Available from Media Services. 147L-5-16, $2.50, 23 pages.

Wildlife in Today's Landscapes. *In press*, will be available from Media Services, June 1990.

Solid Waste

Composting: Wastes to Resources. *In press*, will be available from Media Services, mid-1990.

Recycling in Your School Makes Good Sense. Slide set. Available from Audio Visual Center. Rental price $18, purchase price $42. Set includes 46 slides, cassette, and script.

Recycling: Mining Resources from Trash. *In press*, will be available from Media Services.

What About Waste? *In press*. Will be available from Media Services, late 1990.

Woodsy's Resource Goldmine. Slide set. Available from Audio Visual Center. Rental price $18, purchase price $46. Set includes 52 slides, cassette, and script.

Woodsy's Wastewise. Slide set #303. Available from Audio Visual Center. Rental price $20, purchase price $39.

Other

Renewable Natural Resource-Based Businesses for Enterprising Youth. Available from DNR, $1.10, 22 pages.

Ordering Information for Publications and Slide Sets

Audio Visual Center
8 Cornell Business and Technology Park
Cornell University
Ithaca, New York 14850
(607) 255-2090

Department of Natural Resources (DNR)
4-H Youth Development Program
108 Fernow Hall
Cornell University
Ithaca, New York 14853
(607) 255-2814

Instructional Materials Services
109 Kennedy Hall
Cornell University
Ithaca, New York 14853
(607) 255-9252

Media Services Distribution Center
7 Cornell Business and Technology Park
Cornell University
Ithaca, New York 14850
(607) 255-2080

For more information, contact your
local Cornell Cooperative Extension office.

Cornell
Cooperative
Extension

Helping You
Put Knowledge
to Work

This publication is issued to further Cooperative Extension work mandated by acts of Congress of May 8 and June 30, 1914. It was produced with the cooperation of the U.S. Department of Agriculture and Cornell Cooperative Extension, College of Agriculture and Life Sciences, College of Human Ecology, and College of Veterinary Medicine, at Cornell University. Cornell Cooperative Extension provides equal program and employment opportunities. Lucinda A. Noble, Director.

4/90 U E90712 *printed on recycled paper*

Compost Project Record

Name: _____

Date: _____

Type of compost system used (include a diagram):

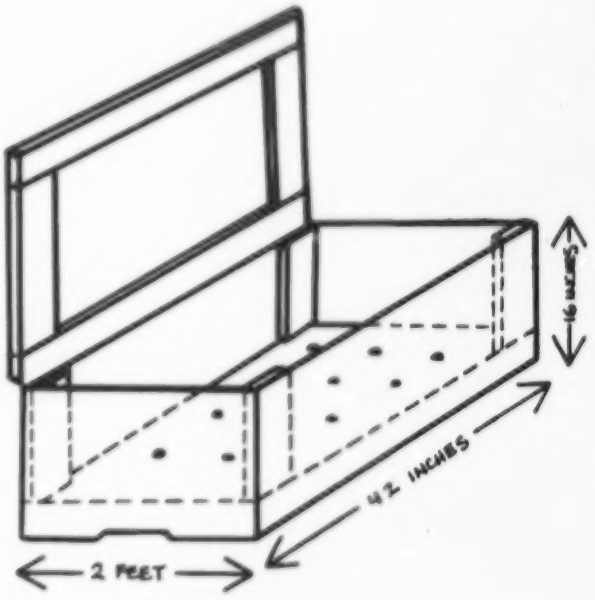
Wastes added to compost pile:

Any problems? How did you solve them?

What did you learn from your compost project?

Worm Composting Bin

Worms in the house? Yuk! But this composting system actually works! The worms stay in the box and eat household scraps, and the box gives off little odor. Worm composting can be done in apartment buildings or other homes with no yard space. You might try it in your school!



What You Need

Materials

- 1 4-x-8-foot sheet of 1/2-inch exterior plywood
- 1 12-foot length of 2 x 4 lumber
- 1 16-foot length of 2 x 4 lumber
- 1/2 pound of 16d galvanized nails
- 2 pounds of 6d galvanized nails
- 2 galvanized door hinges
- optional: 1 pint of clear varnish or polyurethane
- optional: plastic sheets for placing under and over the bin
- 1 pound of worms for every 1/2 pound of food wastes produced per day
  (Worms sold as fishing bait are best. Red worms are available from Flowerfield Enterprises, 10332 Shaver Road, Kalamazoo, MI 49002, 616-327-0108.)
- bedding for worms: moistened shredded newspaper or cardboard, peat moss, or brown leaves

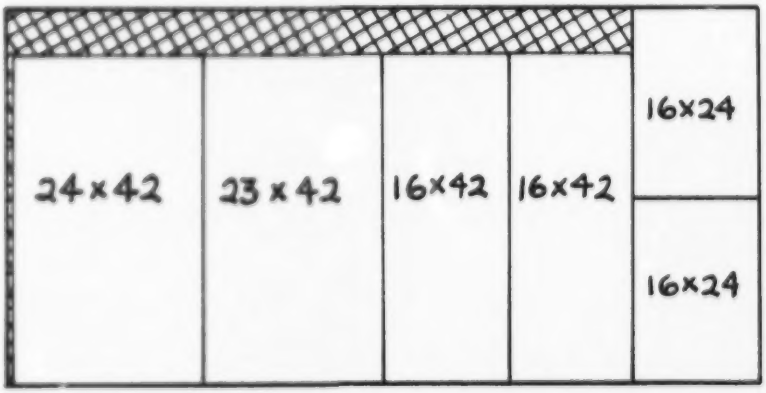
Tools

- tape measure
- skill saw or hand saw
- hammer
- saw horses
- long straight-edge or chalk snap line
- screwdriver
- drill with 1/2-inch bit
- eye and ear protection
- work gloves
- optional: paint brush

Building a Worm Composting Bin

1. Measure and cut the plywood as shown, so you have one 24-x-42-inch top, one 23-x-42-inch base, two 16-x-24-inch ends, and two 16-x-42-inch sides.
2. Cut the 12-foot length of 2 x 4 lumber into five pieces: two 39-inch pieces, two 23-inch pieces, and one 20-inch piece.
3. Lay the five pieces on edge on a flat surface to form a rectangle with the long pieces on the inside and the 20-inch length centered parallel to the ends. Nail the pieces together with two 16d nails at each joint.

continued on next page



4. Nail the 23-x-42-inch piece of plywood onto the frame with 6d nails every 3 inches.
5. Cut four 1-foot lengths from the 16-foot length of 2 x 4 lumber. (Save the remaining 12-foot piece). Take the two 16-x-42-inch pieces of plywood and place a 1-foot length flat against each short end and flush with the top and side edges. Nail the 2 x 4s in place using 6d nails.
6. Set the plywood sides up against the base frame so the bottom edges of the 2 x 4s rest on top of the base frame and the bottom edges of the plywood sides overlap the base frame. Nail the plywood sides to the base frame using 6d nails.
7. To complete the box, nail the 16-x-24-inch pieces of plywood onto the base and sides at each end.
8. To reinforce the box, make sure a nail is staggered at least every 3 inches wherever plywood and 2 X 4s meet.
9. Drill 12 one-half-inch holes through the plywood bottom of the box for drainage.
10. To build the frame for the lid, cut the remaining 12-foot piece of the 16-foot length of 2 x 4 lumber into two 45-inch pieces and two 20-inch pieces. Lay the pieces flat to form a rectangle, with the short pieces on the inside.
11. Lay the 24-x-42-inch piece of plywood on top of the lid frame so the plywood is 1 1/2 inches inside all the edges of the frame. Nail the plywood onto the frame with 6d nails.
12. Attach the hinges to the inside of the back of the box at each end (on the 2 x 4) and the corresponding undersides of the back edge of the lid frame, so the lid stands upright when opened.
13. The unfinished box should last for at least five years; finishing the box with varnish or polyurethane, however, will protect the wood and prolong the life of the box. Two coats of varnish with a light sanding between coats should be sufficient.
14. Find a good location for the box. It can be placed anywhere as long as the temperature is more than 50°F (10°C). The most productive temperature is 55° to 77°F (13° to 25°C). Garages, basements, and kitchens are all possibilities as well as the outdoors in warm weather (not in direct sunlight). Make sure to place the box where it is convenient for you to use. It is wise to place a plastic sheet under the box.

Adding the Worms

Moisten the bedding material for the worms by placing it in a 5-gallon bucket and adding enough water to dampen all the material. Don't worry about getting the bedding material too wet because the excess moisture will drain off when it is placed into the composting bin. Be careful if you use peat moss because it will hold too much water. It is a good idea to put wet bedding material into the bin outdoors and wait until all the water has drained out (one to two hours).

Add about 8 inches of moistened bedding to the bottom of one side of the bin. In go the worms! Leave the lid off for a while and the worms will work down into the bedding away from the light.

Adding Your Wastes

Dig a small hole in the bedding and add your vegetable and fruit scraps. Then cover the hole with bedding. Small amounts of meat scraps can be added in the same way. Do not add any inorganic or potentially hazardous material such as chemicals, glass, metal, or plastic.

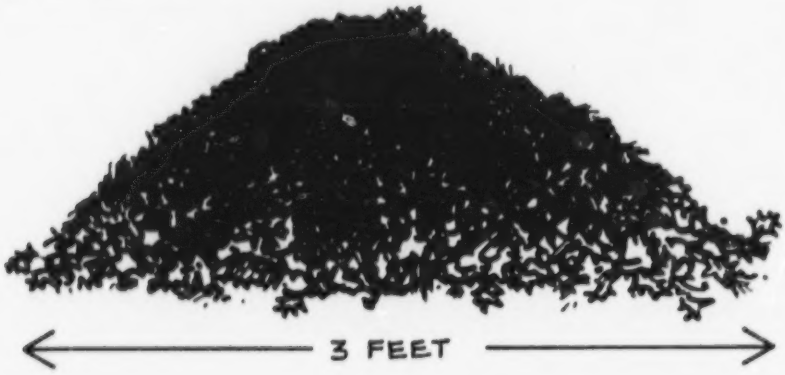
Maintaining Your Compost Pile

Keep your compost pile moist, but not wet. If flies are a problem, place more bedding material over the wastes or a sheet of plastic over the bedding, or try placing some flypaper inside the lid. Every three to six months, move the compost to one side of the bin and add new bedding to the empty half. At this time, add food wastes to the new bedding only. Within one month, the worms will crawl over to the new bedding and the finished compost on the "old" side can be harvested. Then add new bedding to the "old" side.

COMPOSTING: Wastes to Resources • Cornell Cooperative Extension
4/90 GPP E90712 *printed on recycled paper*

Compost Mound

Yard wastes can be composted without a bin if you don't mind the appearance of an uncontained compost mound in your yard. The only costs are your time and work.



What You Need

- shovel or pitchfork
- work gloves

Building a Compost Mound

Find a good location and pile your yard waste in a mound about 3 feet x 3 feet x 3 feet (1 meter x 1 meter x 1 meter). If you cover the pile with a layer of soil, it will keep in moisture for the microorganisms and soil animals working to make compost.

Adding Wastes

Add wastes as they become available. Nonwood materials such as grass clippings and garden wastes work best.

Maintaining Your Compost Pile

It is best to have two piles. After the first pile is large enough, stop adding organic material and let it work. In the meantime, add your wastes to the second pile.

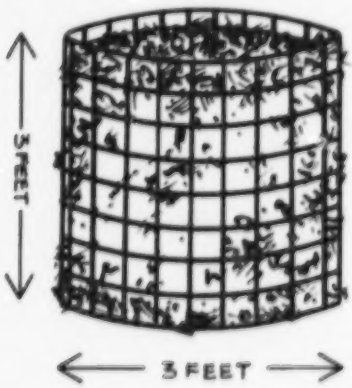
Make sure the pile is moist, especially if it is not covered with soil.

You can turn the pile to speed up composting. Compost should be ready in three to four months if you turn the pile, or in about one year if you don't turn the pile.

COMPOSTING: Wastes to Resources • Cornell Cooperative Extension
4/90 GPP E90712 *printed on recycled paper*

Wire Mesh Bin

A wire mesh bin is inexpensive and easy to build out of either galvanized chicken wire or hardware cloth. (Nongalvanized chicken wire can also be used but will not last very long.) Posts provide more stability for a chicken wire bin, but make the bin difficult to move. A wire mesh bin made without posts is easy to lift, allowing you to get at the compost that is already "done" at the bottom of the pile while the top of the pile is still cooking.



What You Need

Materials

- 12 1/2 feet of 36-inch-wide 1-inch galvanized chicken wire or 1/2-inch hardware cloth
- heavy wire for ties
- 3 or 4 4-foot wooden or metal posts (for chicken wire bin)

Tools

- heavy-duty wire or tin snips
- pliers
- hammer (for chicken wire bin)
- metal file (for hardware cloth bin)
- work gloves

Building a Wire Mesh Bin

If using chicken wire:

1. Fold back 3 to 4 inches of wire at each end of the cut piece to provide a strong, clean edge that won't poke or snag and which will be easy to latch.
2. Stand the wire in a circle and set it in place for the compost pile.
3. Cut the heavy wire into lengths for ties. Attach the ends of the chicken wire together with the wire ties, using pliers.
4. Space wood or metal posts around the inside of the chicken wire circle. Holding the posts tightly against the wire, pound them firmly into the ground to provide support.

If using hardware cloth:

1. Trim the ends of the hardware cloth so the wires are flush with a cross wire to get rid of edges that could poke or scratch hands. Lightly file each wire along the cut edge to ensure safe handling when opening and closing the bin.
2. Bend the hardware cloth into a circle, and stand it in place for the compost pile.
3. Cut the heavy wire into lengths for ties. Attach the ends of the hardware cloth together with the wire ties, using pliers.

Adding Wastes

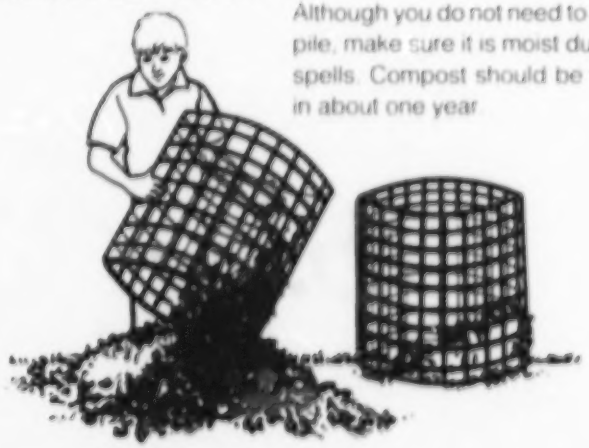
Add wastes as they become available. Nonwood materials such as grass clippings and garden weeds work best. You can speed up the process by chopping or shredding the wastes.

Maintaining Your Compost Pile

As you keep adding wastes to the wire mesh bin, the material at the bottom will become compost sooner than the material at the top. If you want to use the compost at the bottom of the pile, you can remove the wire holding unit and place it next to the pile. Then, use a pitchfork to move the compost back into the moved holding unit, adding the material from the top of the pile first. Continue until you have replaced all the compost. Now the compost at the top of the bin is ready to use.

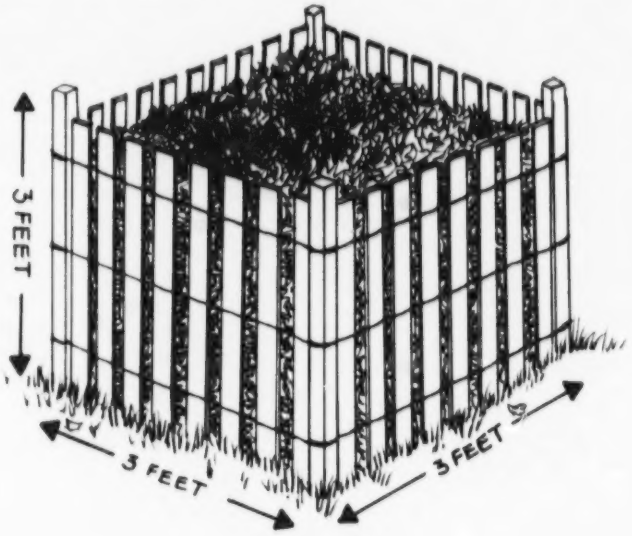
You also can scoop finished compost from the bottom of the pile by lifting one side of the unit.

Although you do not need to turn this pile, make sure it is moist during dry spells. Compost should be finished in about one year.



Snow Fence Bin

A snow fence bin is simple to make. It works best with four posts pounded into the ground for support.



What You Need

Materials

- 4 wooden or metal posts, at least as tall as the snow fence
- heavy wire for ties
- 12 1/2 feet of snow fencing, at least 3 feet tall

Tools

- heavy-duty wire or tin snips
- pliers
- sledge hammer
- work gloves

Building a Snow Fence Bin

1. Choose a 3-foot-square site for your compost bin, and pound the four wooden or metal posts into the ground 3 feet apart, at the corners of the square.
2. Cut the heavy wire into lengths for ties. Attach the snow fence to the outside of the posts with the wire ties, using pliers.
3. Attach the ends of the snow fence together in the same way, forming a 3-foot-square enclosure.

Adding Wastes

Add wastes as they become available. Nonwood materials such as grass clippings and garden weeds work best. You can speed up the process by chopping or shredding the wastes.

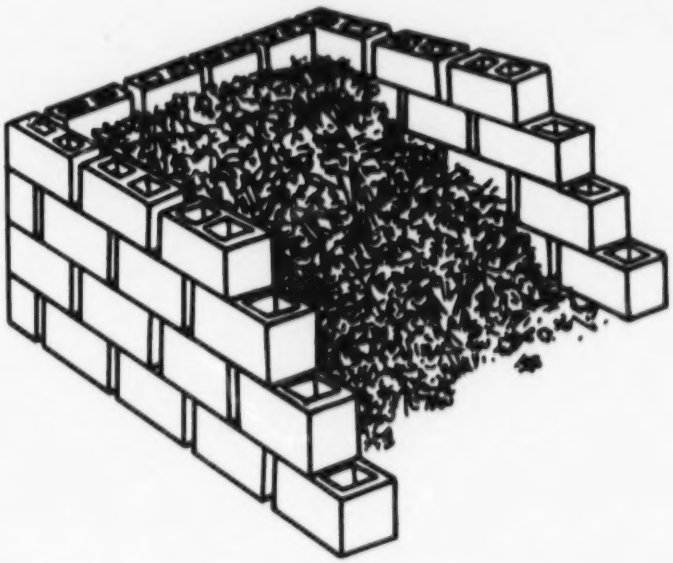
Maintaining Your Compost Pile

Although you do not need to turn this pile, make sure that it is moist during dry spells. Compost should be ready in about one year. Simply remove the fencing and the compost is ready to use.

4/90 GPP E90712 *printed on recycled paper*

Cinder Block Bin

A cinder block bin is sturdy, durable, and easily accessible. If you have to buy the cinder blocks, it is slightly more expensive to build than the wire mesh or snow fence bins.



What You Need

- about 46 cinder blocks for the first bin
- optional: about 32 blocks for a second bin
- work gloves

Building a Cinder Block Bin

1. Place 5 cinder blocks in a row along the ground at your composting site, leaving about 1/2 inch between each block to let in air.
2. Place 4 cinder blocks in another row along the ground perpendicular to and at one end of the first row, forming a square corner; leave about 1/2 inch between each block.
3. In the same way, place 4 cinder blocks at the opposite end of the first row to form a three-sided enclosure.
4. Add a second layer of blocks, staggering them to increase stability and leaving about 1/2 inch between each block. There should be a layer of 4 cinder blocks on each of the three walls of the enclosure.
5. Add a third layer of blocks, again staggering them to increase stability, with 5 blocks across the back of the enclosure and 3 on each side.
6. The last and top layer should have 4 blocks across the back and 3 on each side.
7. Optional: If you wish to decrease your composting time, build a second bin next to the first so the wastes in one can mature while you add wastes to the other. Use one side wall of the first bin so you only need to build two additional walls.

Adding Wastes

Add wastes as they become available. Nonwood materials such as grass clippings and garden weeds work best. You can speed up the process by chopping or shredding the wastes. If you have two units, when the first unit is full let the compost mature and add wastes to the second unit.

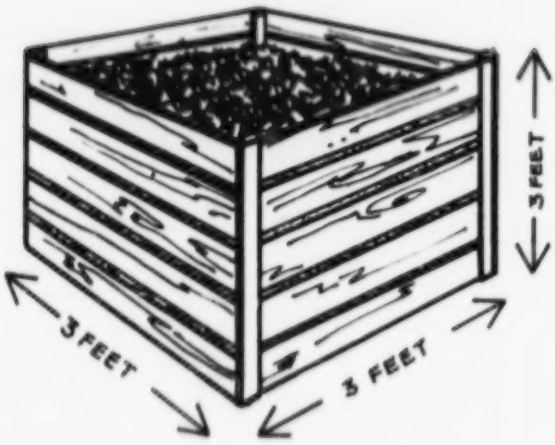
Maintaining Your Compost Pile

Although you do not need to turn this pile, make sure that it is moist during dry spells. Compost should be ready in about one year or more.

COMPOSTING: Wastes to Resources • Cornell Cooperative Extension
4/90 GPP E90712 *printed on recycled paper*

Wooden Box Bin

A wooden box bin can be built inexpensively using wooden pallets. Or you can use lumber to make a nicer looking bin. The costs will vary, depending on whether you use pallets or new lumber. Used pallets are often available from manufacturers and landfills.



What You Need

Materials

- 4 wooden pallets (5 pallets if you want a bottom in the container), sized to make a four-sided container at least 3 feet x 3 feet x 3 feet
- nails
- wire ties

or

- 1 12-foot length of 2 x 4 lumber
- 5 12-foot lengths of lumber, 6 X 3/4
- nails

Tools

- saw
- sledge hammer
- work gloves

Building a Wooden Box Bin

If using wooden pallets:

1. Nail or wire four pallets together to make a four-sided container at least 3 feet x 3 feet x 3 feet. The container is ready to use.
2. A fifth pallet can be used as a base to allow more air to get into the pile and to increase the stability of the bin.

If using lumber:

1. Saw the 12-foot length of 2 x 4 lumber into four pieces, each 3 feet long, to be used as corner posts.
2. Choose a 3-foot-square site for your compost bin, and pound the four posts into the ground 3 feet apart, at the corners of the square.
3. Saw each of the five 12-foot boards into four 3-foot pieces. Allowing five boards to a side and starting at the bottom, nail the boards to the posts to make a four-sided container. Leave 1/2 inch between the boards to allow air to get into the pile.
4. If you wish to decrease your composting time, build a second holding unit so the wastes in one can mature while you add wastes to the other.

Adding Wastes

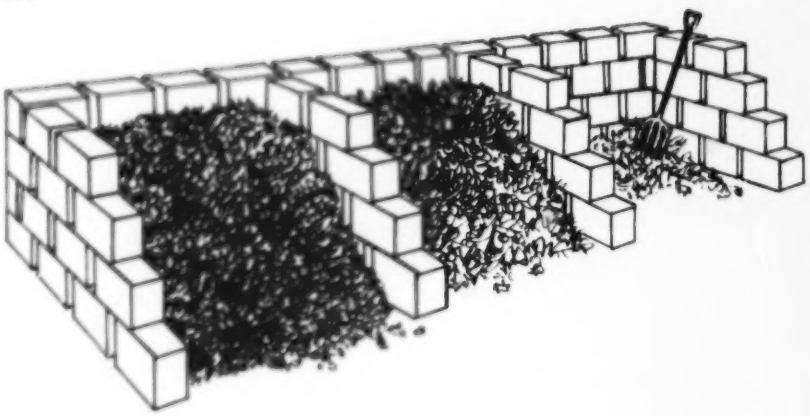
Add wastes as they become available. Nonwood materials such as grass clippings and garden weeds work best. You can speed up the process by chopping or shredding the wastes. If you have two units, when the first unit is full let the compost mature and add wastes to the second unit.

Maintaining Your Compost Pile

Although you do not need to turn this pile, make sure that it is moist during dry spells. Compost should be ready in about one year.

Cinder Block Turning Unit

A cinder block turning unit looks like three cinder block holding units in a row. It is sturdy, and if you can find used cinder blocks, it is inexpensive to build.



What You Need

- about 98 cinder blocks
- work gloves

Building a Cinder Block Turning Unit

1. Place 12 cinder blocks in a row along the ground at your composting site, leaving about 1/2 inch between each block to let in air.
2. Place 4 cinder blocks in another row along the ground perpendicular to and at one end of the first row, forming a square corner, leave about 1/2 inch between each block.
3. In the same way, place 4 cinder blocks at the opposite end of the first row to form a three-sided enclosure.
4. Place two more rows—4 cinder blocks each—along the ground, parallel to the ends and evenly spaced within the enclosure. This divides the enclosure into three separate bins.
5. Add a second layer of blocks, staggering them to increase stability and leaving about 1/2 inch between each block. There should be a layer of 13 cinder blocks across the back and 3 cinder blocks on the sides of each bin.
6. Add a third layer of blocks, again staggering them to increase stability, with 12 blocks across the back of the enclosure and 3 on each side.
7. The last and top layer should have 13 blocks across the back and 2 on each side.

Adding Wastes

Do not add wastes as they become available with this system. Collect enough wastes to fill one of the three bins at one time. You can collect woody as well as nonwood wastes. Add thin layers of different kinds of organic materials or mix the wastes together.

Before adding new wastes to an empty bin, collect enough to fill the entire bin.

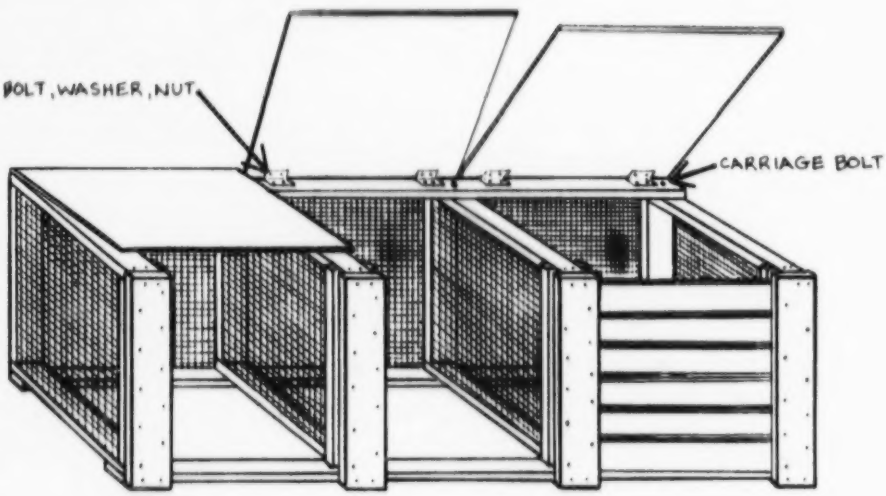
Maintaining Your Compost Pile

Take the temperature of your pile every day. After a few days, the temperature should reach between 130° and 140°F (54° to 60°C). If your pile gets very hot, turn it before the temperature gets above 155°F (68°C). In a few days, the temperature will start to drop. When the temperature starts going down, turn your compost pile into the next bin with a pitchfork. The temperature of your compost pile will increase again and then, in about four to seven days, start to drop. Turn your compost pile into the third bin. Continue to take the temperature and turn the compost pile until the compost is ready. The compost should be ready in about one or two months.

COMPOSTING: Wastes to Resources • Cornell Cooperative Extension
4/90 GPP E90712 *printed on recycled paper*

Wood and Wire Three-Bin Turning Unit

A wood and wire three-bin turning unit can be used to compost large amounts of yard, garden, and kitchen wastes in a short time. Although relatively expensive to build, it is sturdy, attractive, and should last a long time. Construction requires basic carpentry skills and tools.



What You Need

Materials

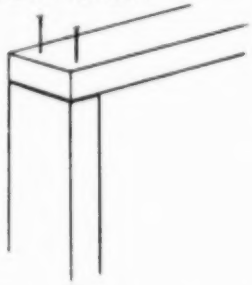
- 4 12-foot (or 8 6-foot) lengths of pressure-treated 2 x 4 lumber
- 2 10-foot lengths of pressure-treated 2 x 4 lumber
- 1 10-foot length of construction grade 2 x 4 lumber
- 1 16-foot length of 2 x 6 lumber
- 6 8-foot lengths of 1 x 6 lumber
- 1 4-x-8-foot sheet of 1/2-inch exterior plywood
- 1 4-x-4-foot sheet of 1/2-inch exterior plywood
- 22 feet of 36-inch-wide 1/2-inch hardware cloth
- 2 pounds of 16d galvanized nails
- 250 poultry wire staples (or a power stapler with 1-inch galvanized staples)
- 12 1/2-inch carriage bolts 4 inches long
- 12 washers and 12 nuts for the bolts
- 6 3-inch zinc-plated hinges
- 24 washers and 24 nuts for the hinges
- 1 quart wood preservative or stain

Tools

- tape measure
- hand saw or circular power saw
- hammer
- tin snips
- carpenter's square
- optional: power stapler with 1-inch galvanized staples
- drill with 1/2-inch bit
- screwdriver
- 3/4-inch socket or open-ended wrench
- pencil
- safety glasses
- ear protection
- dust mask
- work gloves

Building a Wood and Wire Three-Bin System

1. Cut two 31 1/2-inch and two 36-inch pieces from a 12-foot length of pressure-treated 2 x 4 lumber. Butt joint and nail the four pieces into a 35-inch x 36-inch "square." Repeat, building three more frames with the remaining 12-foot lengths of 2 x 4 lumber.



2. Cut four 37-inch lengths of hardware cloth. Fold back the edges of the wire 1 inch. Stretch the pieces of hardware cloth across each frame. Make sure the corners of each frame are square and then staple the screen tightly into place every 4 inches around the edge. The wood and wire frames will be dividers in your composter.

continued on next page

3. Set two dividers on end 9 feet apart and parallel to one another. Position the other two dividers so they are parallel to and evenly spaced between the end dividers. The 36-inch edges should be on the ground. Measure the position of the centers of the two inside dividers along each 9-foot edge.

4. Cut a 9-foot piece from each 10-foot length of pressure-treated 2 x 4 lumber. Place the two treated boards across the tops of the dividers so each is flush against the outer edges. Measure and mark on the 9-foot boards the center of each inside divider.

5. Line up the marks, and through each junction of board and divider, drill a 1/2-inch hole centered 1 inch in from the edge. Secure the boards with carriage bolts, but do not tighten them yet. Turn the unit so the treated boards are on the bottom.

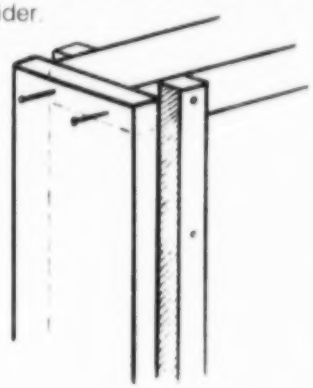
6. Cut one 9-foot piece from the 10-foot length of construction grade 2 x 4 lumber. Attach the board to the back of the top by repeating the process used to attach the base boards. Using the carpenter's square or measuring between opposing corners, make sure the bin is square. Tighten all the bolts securely.

7. Fasten a 9-foot length of hardware cloth to the back side of the bin with staples every 4 inches around the frame.

8. Cut four 36-inch-long pieces from the 16-foot length of 2 x 6 lumber for front runners (Save the remaining 4-foot length.) Rip cut two of these boards to two 4 3/4-inch-wide strips. (Save the two remaining strips.)

9. Nail the 4 3/4-inch-wide strips to the front of the outside dividers and baseboard so they are flush on the top and the outside edges. Center the two remaining 6-inch-wide boards on the front of the inside dividers flush with the top edge and nail securely.

10. Cut the remaining 4-foot length of 2 x 6 lumber into a 34-inch-long piece and then rip cut this piece into four equal strips. Trim the two strips saved from step 8 to 34 inches. Nail each 34-inch strip to the insides of the dividers so they are parallel to and 1 inch away from the boards attached to the front. This creates a 1-inch vertical slot on the inside of each divider.



11. Cut the 6 8-foot lengths of 1 x 6 lumber into 18 slats, each 31 1/4 inches long. Insert the horizontal slats, 6 per bin, between the dividers into the vertical slots.

12. Cut the 4-x-8-foot sheet of exterior plywood into two 3-x-3-foot pieces. Cut the 4-x-4-foot sheet of exterior plywood into one 3-x-3-foot piece. Center each 3-x-3-foot piece on one of the three bins and attach each to the back top board with two hinges.

13. Stain all untreated wood.

Adding Wastes

Do not add wastes as they become available with this system. Collect enough wastes to fill one of the three bins at one time. You can collect woody as well as nonwood wastes. Add thin layers of different kinds of organic materials or mix the wastes together.

Before adding new wastes to an empty bin, collect enough to fill the entire bin.

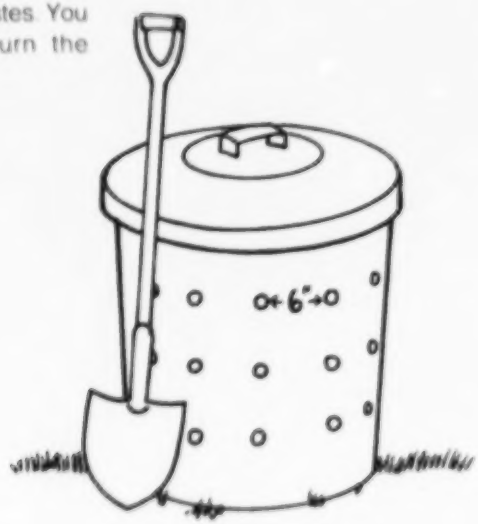
Maintaining Your Compost Pile

Take the temperature of your pile every day. After a few days, the temperature should reach between 130° and 140°F (54° to 60°C). If your pile gets very hot, turn it before the temperature gets above 155°F (68°C). In a few days, the temperature will start to drop. When the temperature starts going down, turn your compost pile into the next bin with a pitchfork. The temperature of your compost pile will increase again and then, in about four to seven days, start to drop. Turn your compost pile into the third bin. The total time for composting should be less than one month.

COMPOSTING: Wastes to Resources • Cornell Cooperative Extension
450 GPP E90712 *printed on recycled paper*

Garbage Can Composter

A garbage can composter is inexpensive and easy to build. It can be used for food or garden wastes. You do, however, need to turn the wastes.



What You Need

Materials

- garbage can with cover
- coarse sawdust, straw, or wood chips

Tools

- drill
- pitch fork, shovel, or compost turner
- work gloves

Building a Garbage Can Composter

1. Drill three rows of holes 4 to 6 inches apart all around the sides of the garbage can. Then drill several holes in the base of the can. The holes allow air movement and the drainage of excess moisture.
2. Place 2 to 3 inches of dry sawdust, straw, or wood chips in the bottom of the can to absorb excess moisture and let the compost drain.

Adding Wastes

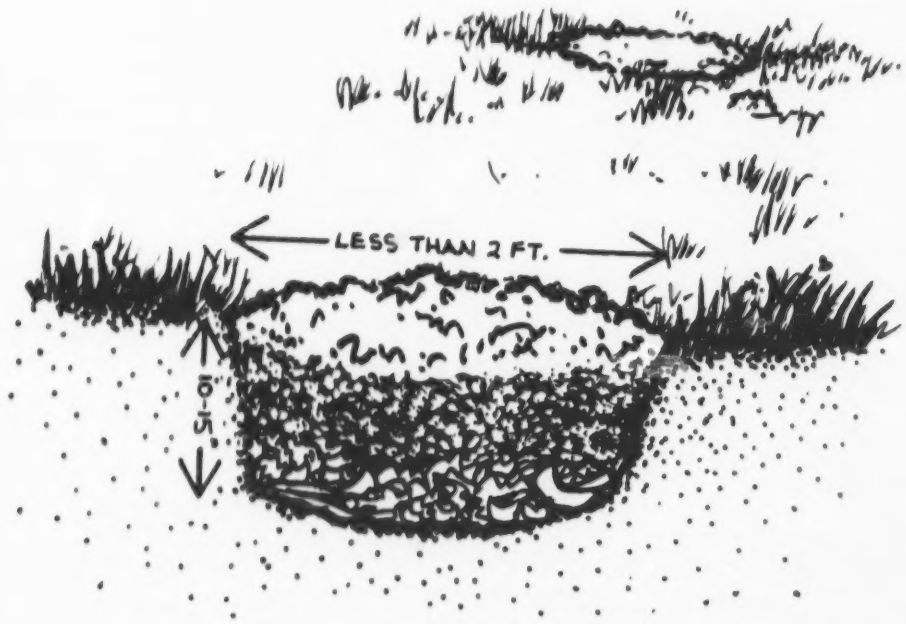
Add fruit, vegetable, and garden wastes. Make sure not to add too much of any one waste at a time.

Maintaining Your Compost Pile

Regularly mix or turn the compost with a pitch fork, shovel, or compost turner and keep it covered. This adds air and mixes up the different wastes, preventing the compost from getting smelly. A smelly compost pile may attract animals and cause neighbors to complain.

Compost Pockets

This is an easy composting shortcut. You bury your fruit and vegetable wastes in small pockets in your garden, and let the microorganisms and soil animals do the work. Store your kitchen scraps in a plastic container until you are ready to compost them.



What You Need

Materials

- food wastes, collected in a plastic container or bucket

Tools

- shovel
- work gloves

What to Do

1. Dig holes 10 to 15 inches deep and less than 2 feet across.
2. Place food wastes in the holes and cover with soil. Make sure the soil cover is at least 8 inches deep so the buried materials do not attract animals.

COMPOSTING: Wastes to Resources • Cornell Cooperative Extension
4/90 GPP E90712 *printed on recycled paper*

Mulch

Mulch is placed on top of the soil in gardens or around trees to suppress weeds, keep soil moist, keep plant roots cool in summer and warm in winter, and prevent soil from washing away or becoming hard. Yard wastes can be used as mulch and placed around plants in the garden or along paths and in play areas. The only costs are your time and work. You can also mulch with compost made using one of the systems described in the leader's/teacher's guide.

What You Need

Materials

For annual flower beds and vegetable gardens:

- lawn clippings or leaves from deciduous trees and shrubs

For trees and shrubs:

- wood chips, lawn clippings, sawdust, leaves from deciduous trees and shrubs, pine needles, manure

For pathways and play areas:

- wood chips or sawdust

Tools

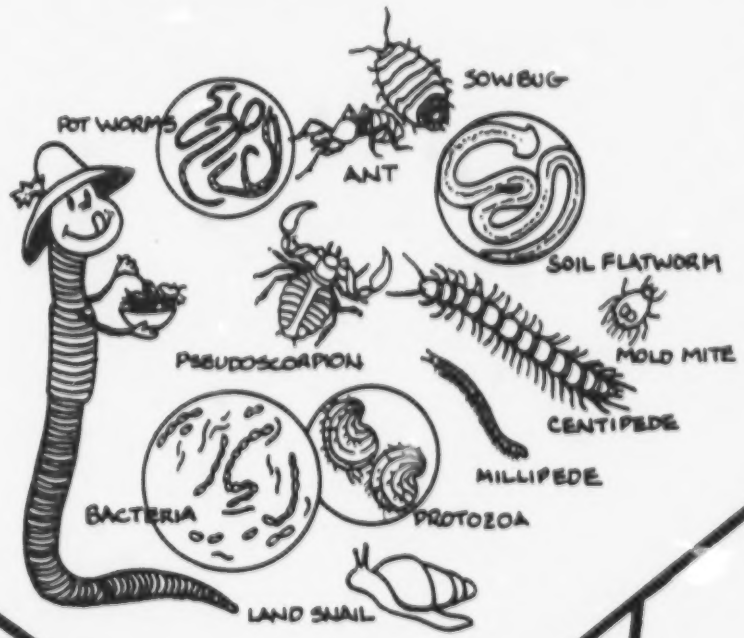
- shovel
- wheel barrow
- rake
- work gloves

What to Do

1. Spread your mulch in the garden, around the base of a tree, or in a path or play area. Rake it smooth.
2. Place mulch around the trees as illustrated in the diagram. Mulching trees helps keep moisture in the soil and protects plants during cold weather.

How Does Com

1. We are the key to composting. We love to eat banana peels, rotten apples, brown wilted lettuce, fallen leaves, and weeds from your garden.



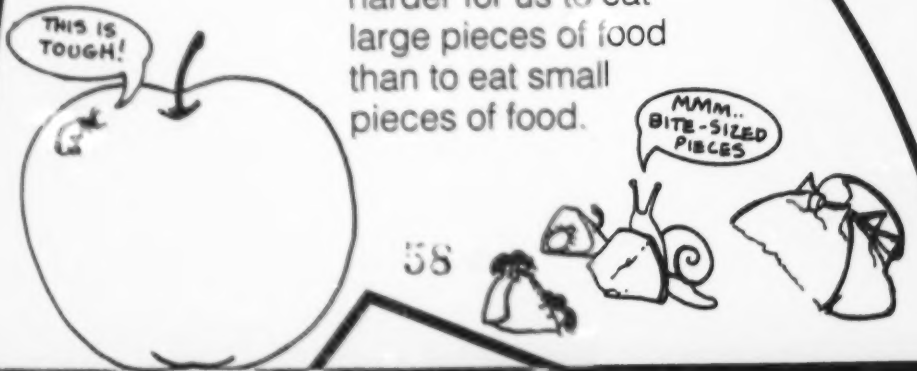
BEST COPY AVAILABLE

2 We need

posting Work?

7. If you supply all these things—food, air, and moisture in a good-sized pile—we will be glad to make compost for you.

6. We must be able to get to our food! It is harder for us to eat large pieces of food than to eat small pieces of food.

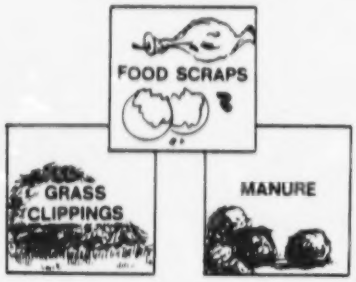


a balanced diet! We need carbon for energy and nitrogen to help build our bodies. Some of your wastes are high in carbon. These include

- paper
- sawdust
- wood chips
- straw
- leaves.

Other wastes are high in nitrogen. These include

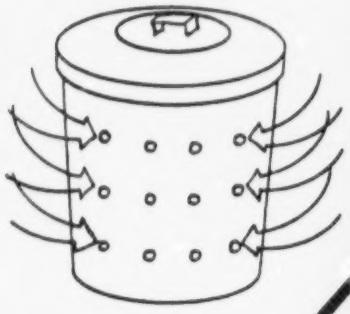
- food scraps
- grass clippings
- manure.



Be sure to include a mixture of wastes high in carbon and wastes high in nitrogen in your compost pile.

3. Don't smother us! We need air to survive. If we don't have air, the compost pile will turn smelly!

Be sure your compost container has holes in allow air to get into the pile. If possible, stir or compost pile every we in more air.



Cornell Cooperative Extension

Helping You Put Knowledge to Work

5. Don't let us get cold! We like temperatures of 90° to 140°F (32° to 60°C). If your compost pile is too small, we will feel the cold air coming in from the sides.

The best way to keep us warm is to build a pile that is at least 3 feet x 3 feet x 3 feet (1 meter x 1 meter x 1 meter).

4. Don't let us dry out! We need water. Your compost pile should be about as moist as a sponge that has just been wrung out.

to
compost
urn your
ek or so to let

If there is not much rainfall, add water to your compost pile.

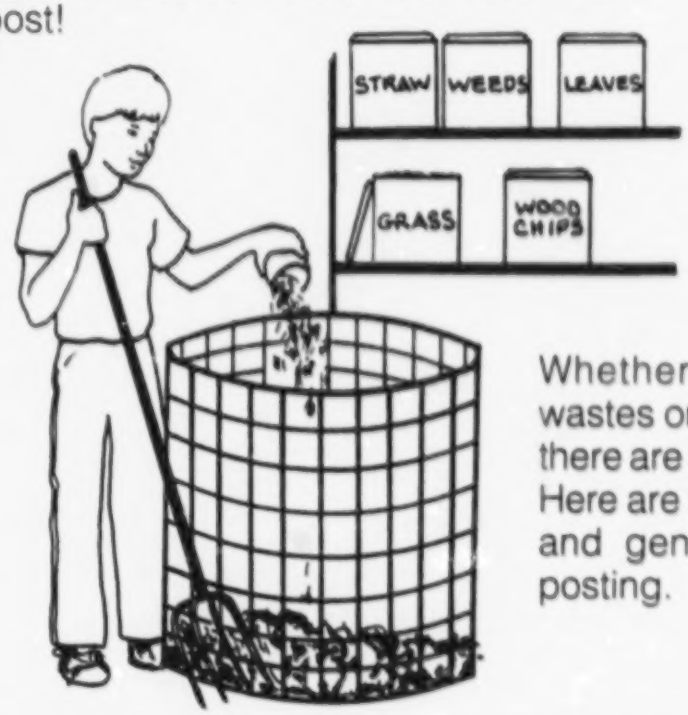
printed on recycled paper

4/90 CP EB0712

Best Evel

Just Follow the Recipe!

Composting is like baking a cake. Simply add the ingredients, stir, "bake," and out comes—compost!



Whether you compost kitchen wastes or yard and garden wastes, there are a few basic steps to follow. Here are the necessary ingredients and general directions for composting.

Directions

1. Choose a "pot" for baking your

4. Adjust the moisture in your com-

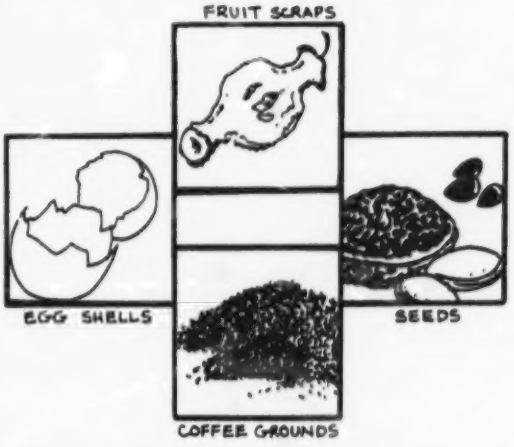
Compost

Ingredients

Kitchen Compost

Add a mixture of some or all of the following ingredients:

- vegetable peels and seeds
- fruit peels and seeds
- coffee grounds
- egg shells
- nut shells
- any other vegetable or fruit scraps



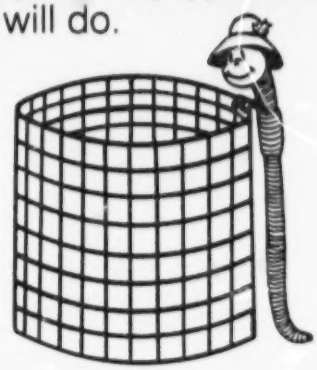
(Do not add meat scraps, bones, dairy products, oils, or fat. They may attract pesty animals.)

Yard or Garden Compost

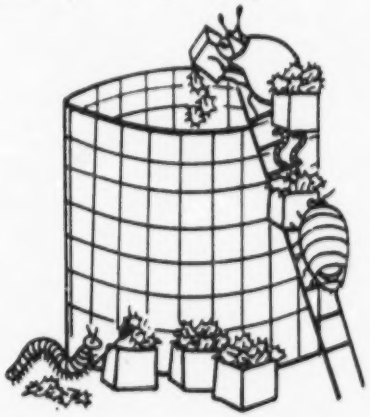
Add a mixture of some or all of the following ingredients:

- hay or straw
- grass clippings
- leaves
- ashes

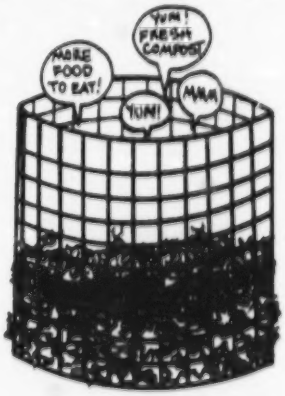
compost. Any type of composting bin will do.



2. Place kitchen or yard wastes into the composting bin. Chop or shred the organic materials if you want them to compost quickly.



3. Spread soil or "already done" compost over the compost pile. This layer contains the microorganisms and soil animals that do the work of making the compost. It also helps keep the surface from drying out.



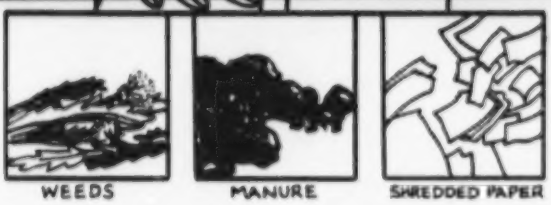
post pile. Add dry straw or sawdust to soggy materials, or add water to a pile that is too dry. The materials should be damp to the touch, but not so wet that drops come out when you squeeze.

5. Allow the pile to "bake." It should heat up quickly and reach the desired temperature (90° to 140°F, or 32° to 60°C) in four to five days.

Cornell Coop
Helping You Put

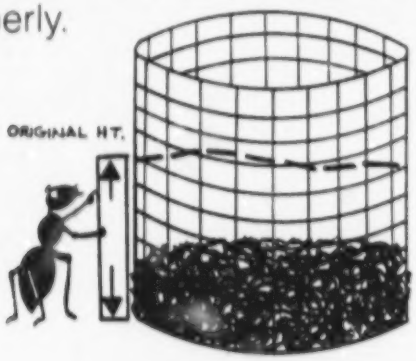
BEST COPY AVAILABLE

- sawdust
- wood chips
- weeds and other garden waste
- manure
- shredded paper



6. Stir your compost as it bakes if you want to speed up the baking time.

7. The pile will settle down from its original height. This is a good sign that the compost is baking properly.



8. If you mix or turn your compost pile every week, it should be "done," or ready to use, in one to two months. If you don't turn it, the compost should be ready in about six to twelve months.

9. Your "best ever compost" should look like dark crumbly soil with small pieces of organic material. It should have a sweet, earthy smell.

10. Feed compost to hungry plants by mixing it with the soil.

rative Extension
nowledge to Work

printed on recycled paper 4/90 CP E90712